AFIT/GEE/CEV/92S-6

DEVELOPMENT OF THE AIR MODULE FOR THE WORK INFORMATION MANAGEMENT SYSTEM - ENVIRONMENTAL SUBSYSTEM (WIMS-ES)

THESIS

Robert A. Cantwell, Captain, USAF
Jonathan S. Davis, Captain, USAF

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THESIS

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Robert A. Cantwell, B.S.

Captain, USAF

Jonathan S. Davis, B.S.

Captain, USAF

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Preface

The purpose of this thesis was to develop and field a management information system (MIS) that any base air program manager could use to maintain an installation's air pollution data. The 1990 amendments to the Clean Air Act will have a great impact on the amount of tracked and reported information concerning air pollution. These amendments also show that Americans have become more aware of the repercussions that their actions have upon the gentle balance of the ecological cycle. We designed this air module for the user, from the user's point of view, and hope that we have succeeded. Appendix E contains a glossary of acronyms.

Many individuals provided us with invaluable support and patience while completing this thesis and without whom it may not have been so successful. Primarily, we want to thank our typist and proofreader, Michell Cantwell. Her speed and accuracy proved to be a lifesaver at times, especially for a couple of men who type maybe ten words a minute (if we're lucky). Carol Roark of the Air Force Materiel Command's Work Information Management System - Environmental Subsystem (WIMS-ES) development team provided us with encouragement, information, and points of contact on the development of the environmental subsystem. We also want to thank our thesis advisor, Captain Jim Donaghue, and our thesis committee member, Captain Randy Schober. Captain

Donaghue gave us the practical knowledge of a person who has worked extensively in the air program. Captain Schober furnished us with valuable information from a base environmental manager's point of view. In addition, we wish to thank Major Dean Kashawagi for his direction and insight during the entire thesis process.

Finally, we must thank our family members. They had to bear many hours of anxiety and frustration, sometimes not quite understanding why daddy was pulling out his hair. The engineering and environmental masters program was very challenging, but we feel we are now better prepared to help teach future generations how to save our planet.

Robert A. Cantwell | Jonathan S. Davis

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Abstract

The primary objective of this research was to develop the air module for the Work Information Management System - Environmental Subsystem (WIMS-ES). The air module will provide Air Force environmental managers with a management information system (MIS) to control the growing amount of air pollution data required to stay in compliance with the newly amended Clean Air Act. To develop the air module, the Air Force's air pollution management requirements were researched first. These requirements were then compared to the capabilities of existing air pollution MISs used in the Department of Defense, the Environmental Protection Agency, and in commercial industry. The research led to a draft air module that tracks a base's source inventory and associated permit, control equipment, and emission information. Each base's data will be fully accessible to headquarters personnel through the fully networked WIMS-ES. The draft air module was validated through an Air Staff review, an Air Force review, and finally, a workshop with Air Force air pollution experts. The finalized air module has been forwarded to the WIMS-ES programmers and will become the Air Force-wide air pollution MIS in early 1993.

DEVELOPMENT OF THE AIR MODULE FOR THE WORK INFORMATION MANAGEMENT SYSTEM - ENVIRONMENTAL SUBSYSTEM (WIMS-ES)

I. Introduction

The Environmental Role of Civil Engineering

The purpose of the Air Force Civil Engineering organization is to "build and operate Air Force installations for global air power, shelter and sustain Air Force people, and protect the environment" (1:1). Building and operating facilities for aircraft operations and personnel have long been civil engineering's traditional roles and have received the most emphasis from Air Force management. However, recent legislation and shifting national attitudes have elevated the environmental protection role to one of the highest Air Force priorities.

In response to the increased emphasis on environmental issues, civil engineering has repositioned itself to insure that each Air Force facility remains in compliance with all regulatory standards. Organizations empowered to enforce these regulatory standards are the United States Environmental Protection Agency (EPA), the individual States, and the local agencies. In the Air Force Logistics Command (AFLC, now part of Air Force Materiel Command (AFMC)), for example, the environmental section was removed from civil engineering and placed directly under the wing commander as a directorate. In other commands, such as the Tactical Air Command (TAC, now part of the Air Combat Command (ACC)), the environmental management section (DEEV) was elevated to the branch level (DEV).

One area receiving increased emphasis in recent years is the funding of environmental programs. Environmental projects have been fully funded, while operations and maintenance budgets have been slashed (31).

Work Information Management System (WIMS)

A management information system (MIS) is a "system that provides to people either data or information relating to an organization's operations" (20:10). The Air Force civil engineering organization has developed an MIS known as the Work Information Management System (WIMS). The WIMS is based on the Wang Virtual Storage (VS) series of minimainframe computers. The WIMS is a network based system of workstations, printers, peripherals, and telecommunications. The typical WIMS system at a single base includes

1. a Wang VS computer with between eight and thirty-two megabytes of random access memory (RAM),
2. a minimum of six 288 megabyte removable disk storage units,

3. at least 128 workstations with differing capabilities stationed throughout the organization,

4. a collection of laser, dot matrix and/or daisy wheel printers, and

5. a series of modems used to network with remote facilities and other installations' WIMS systems by use of the Defense Data Network (DDN). DDN was developed to provide a common data link for computer systems.

The WIMS was initially planned as a database management tool for tracking and controlling the substantial amount of job orders and work orders civil engineering uses to maintain and operate the base facilities and infrastructure. Unfortunately, the WIMS software was not designed to support the needs of the growing environmental function (23).

Environmental Subsystem (ES). In 1989, the Air Staff directed AFLC to design an environmental subsystem to the WIMS (WIMS-ES) (4:1). The objective of the WIMS-ES is to

> ... provide the base environmental manager a management information system that contains essential information, automates mandatory reports, and maintains comprehensive data files on installation environmental programs. (4:2)

The system will be an immense relational database consisting of eleven separate program areas, referred to as modules, all linked to a central module as shown in Figure 1.

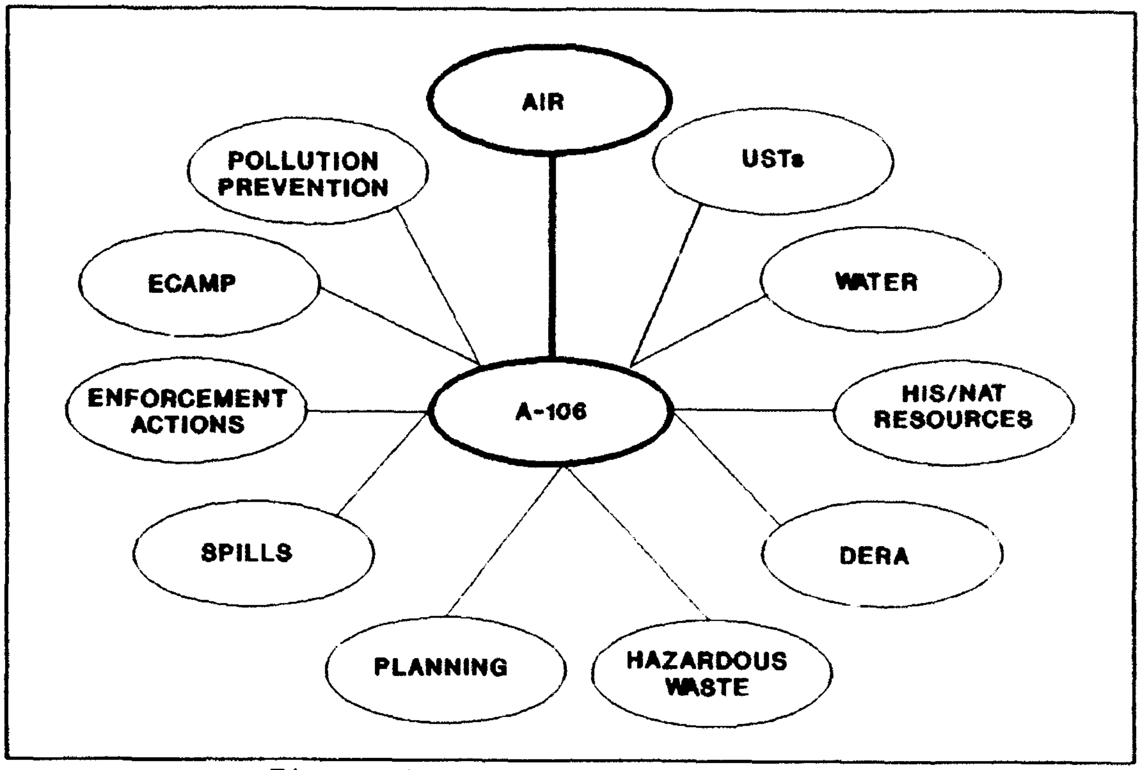


Figure 1. WIMS-ES Modules (4:1)

"The A-106 module will allow the Air Force to electronically meet the requirements of EPA's A-106 process" (30:1). Executive Order 12088 mandated that all federal agencies program their requests for environmental funding through the A-106 process (30:1). As of March, 1992, only the A-106, Defense Environmental Restoration Account (DERA), and Underground Storage Tank (UST) modules had been designed (23).

<u>WIMS-ES</u> <u>Air</u> <u>Module</u>. To assist environmental managers with managing air pollution data, an air module was identified for development within the WIMS-ES at its inception. Since that time, the potential scope of the air

module has increased due to the passage of the Clean Air Act Amendments (CAAA) of 1990 (23).

Clean Air Act Amendments of 1990

On November 15, 1990, President Bush signed the CAAA into law. This law "represents the most significant piece of environmental legislation ever passed to control air pollution" (28:1). The act is divided into eleven separate titles (28:25-43).

1) Title I - Nonattainment: The goal of Title I is to attain and maintain the National Ambient Air Quality Standards (NAAQS). The multi-layered plan in this title extends compliance deadlines to the year 2010.

2) Title II - Mobile Sources: "Title II ... contains provisions relating to the control of mobile source emissions" (28:27). New vehicle emission standards and a clean fuels program compose most of this title.

3) Title III - Hazardous Air Pollutants: This title provides the tools necessary to reduce toxic air emissions. The number of regulated toxic pollutants increased from seven individual pollutants to 189 pollutants or pollutant groups.

4) Title IV - Acid Deposition Control: Title IV introduces a market-based emission allowance program aimed at reducing sulfur dioxide and

nitrogen oxides emissions. These two pollutants are the major contributors to acid rain.

5) Title V - Permits: This title establishes "a comprehensive operating permit program for air emissions" (28:35). The requirements of Title V are some of the most controversial ones within the act (32).

6) Title VI - Stratospheric Ozone Protection: Title VI codifies and expands the Revised Montreal Protocol that was negotiated to protect the ozone layer and preserve the global climate. This law will phase out chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), methyl chloroform, carbon tetrachloride, and halons.

7) Title VII - Enforcement: Title VII expands the EPA's authority to penalize Clean Air Act (CAA) violations. Both civil and criminal enforcement tools are expanded.

8) Titles VIII-XI - Miscellaneous: These titles address such issues as research, disadvantaged business concerns, and unemployment benefits to workers laid off because of Clean Air Act Amendment requirements.

With the CAAA's enactment, the amount of data management required for compliance increased dramatically (7:4, 2:2).

Statement of Problem

Until this research was complete, the WIMS-ES design team did not know the capabilities required of the WIMS-ES air module.

Specific Purpose

The purpose of this research was to determine system requirements, identify air module alternatives, recommend an implementation plan, and design Phase I (Air Staff minimum needs) capabilities for the WIMS-ES air module.

Research Objectives

1. Determine the requirements of an Air Force air pollution management information system.
2. Identify features of air pollution MISs currently being used in the Department of Defense (DoD), the EPA, and industry.
3. Develop and recommend an air module implementation plan to the Air Staff.
4. Upon approval of the implementation plan, design Phase I of the air module.

Justification

With the passage of the Clean Air Act Amendments of 1990, air pollution managers have more information to track and reports to submit than previously required. The Air Staff has mandated the development of an air module for the

WIMS-ES to assist Air Force environmental managers in managing this information.

This thesis provided the WIMS-ES design team with the information required to design the 1992 release of the air module. Additionally, future requirements for the air module were identified.

Scope of the Study

This research was limited to developing the air module for the WIMS-ES. Other modules of the WIMS-ES were researched only to the extent necessary to determine format of the air module and its structural relation to those modules. Even though the potential existed for developing an air module on a stand alone personal computer (PC), the Air Staff mandated the system be used on the WIMS minicomputer.

The researchers did not perform any programming, debugging, or testing. The research was limited to a design specification including sample screens, a data dictionary, a data flow chart, and a control file of input fields.

Limitations of the Research

Since the WIMS-ES uses COBOL (COmmon Business-Oriented Language) as its development language, the air module had to be developed using this language.

Certain mathematical functions required for dispersion modeling could not be performed due to hardware limitations. This limitation can be eliminated by upgrading the central processing unit (CPU) to a higher series (eg VS 12000) computer system (8).

The hardware limitations also prevent any three-dimensional computer graphics (modeling) from being performed. However, this can be overcome by downloading modeling data to a PC-based modeling program.

Thesis Organization

This chapter explained the background of the WIMS-ES and the need for an air module. Chapter II reviews the literature on developing management information systems and investigates current air pollution MISs. The methodology used to develop the air module is explained in Chapter III. Chapter IV discusses the findings and analyzes the results of the research, and contains the final air module design. Finally, Chapter V outlines the conclusions and recommendations of this thesis.

II. Literature Review

Overview

The purpose of this literature review was to examine air pollution MISs in use or under development and to determine the best methodology for developing management information systems. The chapter is divided into four major sections. The first section presents background information on MISs. The second section outlines MIS applications in the environmental management arena. The third section reviews the capabilities of air pollution MISs currently used by the DoD, the EPA, and industry. The final section discusses the steps required to develop an MIS.

Management Information System Background

This section outlines the literature relating to MIS background. Various MIS definitions are discussed first, followed by MIS history and uses. This information forms the basis for a more in-depth discussion of MISs, which is contained in the remainder of this chapter.

Definitions. The term "management information system" has a variety of definitions depending on the text being reviewed. As mentioned in Chapter 1, an MIS can be defined as a system that provides people with data or information relating to an organization's operations (20:10). The "system" in this definition is computer based.

Another definition presents an MIS as a communicative process that transforms data into information that can be used by organizational personnel to make decisions (11:24). Here, the computer is only a part of the total process.

A third definition provides still another view of management information systems: "MIS is the development and use of effective information systems in organizations" (14:6). This definition uses MIS as an active verb, and does not mention computers.

This research defines a management information system as a computer system that manipulates data and presents the data as usable information. The information can then be used to assist the manager with making decisions. In this context, an MIS is both an information reporting system and a decision support system (20:11). This concept is diagrammed in Figure 2.

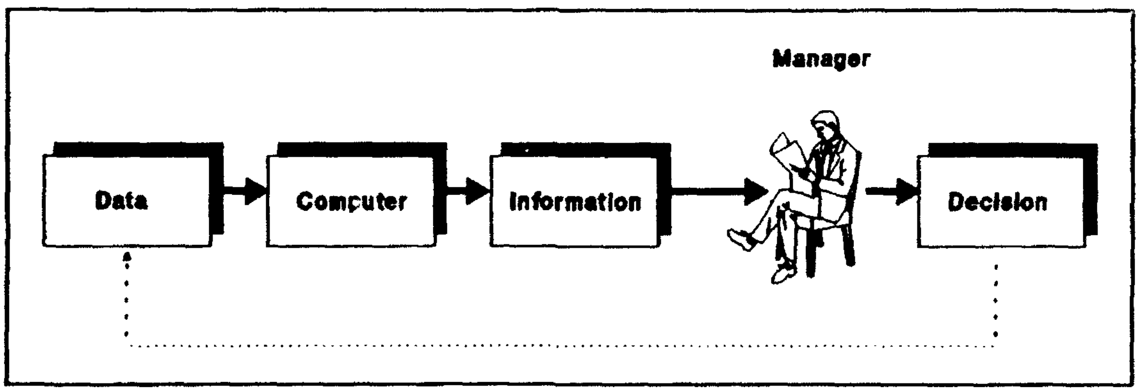


Figure 2. The Processing of Data Into Information (20:13)

<u>MIS History</u>. Computers were first used as data managers in the early 1950's (20:6). These now archaic

machines marked the end of the United States as an industrial society. By 1957, the United States had moved into an information-based economy known as the information age (20:5).

During these early years, the computer was used only as an administrative tool. It was not until the late 1960's that computers were actually used by managers, and the term MIS was coined. By the 1970's, computer systems were moved out from the accounting office's control and given an executive status of their own. This was an indication "that the application of the computer can help in all areas of management rather than just the traditional accounting areas" (11:13). By the 1980's, MISs were recognized as a strategic weapon (20:9).

MIS Uses. Management information systems have been used in just about every data management situation imaginable. As outlined in the following discussion, each MIS "may be composed of any or all of...four component subsystems" (20:395): 1) transaction processing systems, 2) information reporting systems, 3) decision support systems, and 4) office automation.

Transaction Processing Systems (TPS). A transaction processing system automates an organization's business transactions (20:398-421). In this definition, a transaction is an exchange "that affects the financial well-being of an organization" (20:398). TPSs are used primarily for accounting and inventory functions (20:399).

Information Reporting Systems (IRS). "An information reporting system is an information system that provides predefined types of information to management for relatively structured types of decisions" (20:396). The predefined information is given to the manager in the form of a report. Reports usually fall into one of three categories: 1) scheduled report, 2) exception reports, or 3) demand reports (20:424).

Decision Support Systems (DSS). A decision support system gives managers the ability to develop information in a format that will assist the decision making process (20:396). This type of system includes database managers, spreadsheets, modeling packages, and statistical packages (20:440-452).

Office Automation. This type of system is used to automate office tasks. Office automation uses include word processing, desktop publishing, electronic mail, and desktop organizing (20:502-512).

The WIMS contains all four of these components, while the environmental subsystem (WIMS-ES) is composed of only information reporting systems and decision support systems. As the next section explains, the WIMS-ES is part of a growing movement to integrate MISs into the environmental field.

MISs in the Environmental Field

The first environmental management offices began emerging in both the DoD and industry in the 1970's. These offices had predetermined tasks associated primarily with the management of air and water pollution. Since that time, regulatory requirements regarding the tracking and control of hazardous waste and new air and water regulations have changed the Environmental Manager's (EM) responsibilities (7:3).

> In the past few years, there has been a significant increase in the types of environmental issues for which regulatory controls are being imposed. These new regulations are introducing new concepts regarding environmental compliance, and imposing multi-faceted demands on EM groups. These demands involve items such as additional reports, increased interfaces with other site groups, and greater accountability for "on demand" information requests. All these items have placed a significant burden on EM groups regarding the management of information and data (7:3).

To assist Environmental Management Offices with managing information, many software packages have arrived on the commercial market (7). But, environmental MISs must be designed to fit the unique aspects of each organization (7:5). The Air Force recognized this fact and has opted to design its own environmental MIS instead of attempting to "fit" a generic commercial software package (4:1).

Current Air Pollution MISs

The MIS concept of managing information is not used widely in air pollution management. Several systems exist that manage some facets of the air program but not all.

These include MISs to maintain air permit data for completion of a state permit and to track emission inventories. None of the systems reviewed were connected to a mainframe which both affected their ability to network and limited access to a single keyboard. Most systems reviewed were PC based to take advantage of the increased speed of processing and storage capabilities. Perceived user friendliness and color graphics were used as selling points in certain systems.

In this section each air pollution MIS's capabilities will be described. The air pollution MISs reviewed are categorized as DoD systems, commercial packages, and those in use by the EPA.

DoD Systems. Two of the air systems currently used by the DoD are the Air Quality Utility Information System (AQUIS) used by the Air Force and the Navy Air Emissions Tracking System (NAETS). Each system is described in the following sections.

Air Quality Utility Information System (AQUIS). AQUIS was developed to assist with the management of the source inventory, permit tracking, and the estimating and tracking of emissions of AFLC bases (27:2). AFLC was selected for initial use of this system because of the potentially large number of both regulated and unregulated emission sources. The development of this system was begun by Argonne National Laboratory in 1988 in an attempt to satisfy the anticipated inventory requirements called for under the CAAA.

The system is a data base management system that operates on a dedicated IBM-compatible PC using dBase IV (27:2). The system uses dBase's Runtime feature, an active data directory, and a hierarchical set of menus and windows.

> The data elements included in AQUIS were derived from the air quality regulations, the permit application forms and procedures, the annual emissions inventory, and other reporting requirements of those agencies. (27:3)

The data base of AQUIS consists of sources, control equipment, permits, emission points, and connecting links (27:4).

The data from one table is linked to the corresponding data in another table by links that simulate the actual connections (27:10). "Flexibility in defining the possible linkages was needed to avoid complicated attempts to build all the likely connections among the four major information categories into the AQUIS system" (27:10).

> A critical feature of a link is its capability to be connected to multiple sets of information at either end. The multiple linking capability allows the system to handle any number of sources connected through any system of interconnected control devices and stacks. (27:11)

AQUIS calculates emissions for all source categories except for the General Process category. AQUIS calculates emissions for the following six pollutants: particulates less than 10 microns, SO_2, NO_X, CO, VOC, and lead. The EPA's 1988 AP-42 is the basis for emission calculations.

The AP-42 document contains the required formulas for calculating pollutant emissions from a specific source.

A future addition to AQUIS is to allow data exchange capabilities with EPA systems. This will allow air pollution managers to provide regulators with information in a format used by the EPA. The feasibility of implementing AQUIS on a mainframe computer is also being explored (27:14).

<u>Navy Air Emissions Tracking System (NAETS)</u>. This system is a replacement for the Naval Air Pollution Source Information System (NAPSIS) that is used to track air emissions for federal regulation requirements (26:2). The NAETS will be PC-based and modular in design. Each module in this system relates to an individual source type. "Source type classifications coincide with EPA established source types" (26:4). A module will contain information, equations, and algorithms pertinent to that source type (26:3). "Initially, the system will contain approximately 25 individual source modules" (26:3). This system has the ability to calculate emissions or use specified emission estimation techniques. A brief description of the flow of information is as follows:

> After selecting a specific source type, such as heat and steam plant boilers, the program displays a listing of boilers at a base. The user may then browse through the listing to select a specific source. Upon selection, the program then displays information pertaining to that source. The user may then access additional data pertinent to that source, including violation, permit and emission information. (26:4)

source, including violation, permit and emission information. (26:4)

Commercial Systems. Commercial systems are usually designed for an independent company to solve a specific air pollution problem. An example of this is the Master Permit System (MPS) developed by Galson Technical Services, Inc. (Galson) for G.D. Searle and Co. (Searle) of Augusta, Georgia. Searle is a pharmaceutical company that must comply with Georgia state law that requires a formal permit modification for each process change. Another system, the continuous emissions monitoring (CEM) system developed by ETS, Inc. takes the solution of a specific problem further by applying it across the affected population of users.

A new commercial development effort centers around a total integration package. This is the concept of the software package developed by ERM Computer Services. Their ENFLEX DATA system tries to solve a user's total database management needs. Each of these systems is described in the following sections.

Master Permit System (MPS). Searle retained Galson to develop a computer system to streamline the efforts required for the application and review of permit revisions (33:2). The principal purpose of the permit is to ensure compliance of emissions with applicable regulations. This becomes complex since Searle's production process uses various pieces of control equipment depending on the nature of the operation and the quantity of volatiles being released from the process. The development of MPS is a joint effort on the part of Searle and the Georgia Department of Natural Resources, Environmental Protection Division (EPD) (33:4).

The MPS is designed specifically for permitting requirements of the 1990 CAAA. The concept of a master permit is supported by several provisions of the permit program required under Title V of the Amendments (33:11). Also covered by MPS is the requirement under Title I to provide periodic emission statements. The MPS contains a continuous record of modifications in order to document a relationship between past and present operations (33:7).

The MPS contains an emission calculation module specifically designed for batch chemical reactors. This module will provide detailed calculations based on generally accepted engineering principles in addition to using empirical equations developed by the EPA to estimate fugitive emissions from various components. This emission module accounts for emissions of each individual chemical from each process. This is an important consideration in planning for compliance with the 1990 CAAA (33:10). Convenient and accurate emission calculations will be affected by the requirement of source owners to certify accurate assessments.

MPS is a PC-based package written in an application development language compatible with dBase file structures (33:9). Both MPS and the emission module are designed with a module architecture. This allows for additions and modifications to accommodate site-specific and state-specific needs (33:11). MPS runs in a PC-DOS environment.

Integrated Continuous Emissions Monitoring (CEM) Data Management System. This system, a new integrated data management system developed by ETS, attempts to overcome the shortcomings of most commercial systems through the use of a user-friendly software package which integrates data acquisition, data editing, emission calculations, graphical presentation, and final report generation (34:5). This is a PC-based system that is used by stack testing firms for diagnostics, emissions compliance, and facility CEM system certification work (34:2). Though flexible in its design, this system is limited to specific data generated from gas analyzers for emission calculations. The gas analyzers would be connected to stationary sources that are required to be monitored continuously by the CAAA. This system lacks the capability for collecting and storing data from sources that do not require continuous monitoring.

ENFLEX DATA. This system is a comprehensive modular software system with a fully integrated database manager that eases the burden on environmental recordkeeping (6). It was developed by ERM Computer Services of Exton PA. ENFLEX DATA consists of 16 individual modules each working independently but sharing a common database as shown in Figure 3. The system can be PC-based or operate on an IBM or DEC mainframe computer.

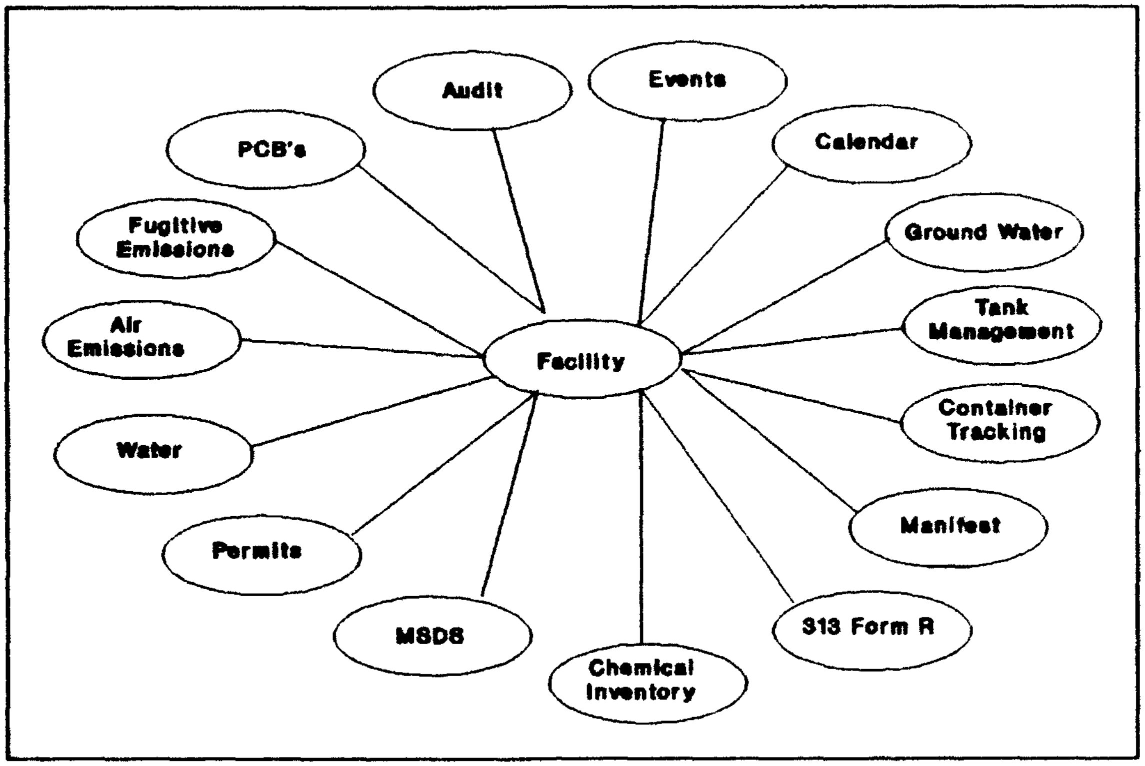


Figure 3. ENFLEX DATA Modules (6)

> ENFLEX DATA takes a proactive approach to compliance. It eliminates time consuming, routine tasks of report preparation, calculations, and file searching, allowing management to quickly evaluate the impact of, or response to, proposed legislation. Also, the modular design allows for growth as recordkeeping needs change. (6)

The ENFLEX DATA system is broken into three subsystems to include Hazardous Materials Management, Environmental Program Management, and Source Management. Modules of particular interest from the Source Management section include the Air Emissions Module, the Fugitive Emissions Module, and the Permits Module. The Air Emissions Module was designed to

> ...monitor air emissions for stacks and other sources including fuel monitoring as well as end-of-stack monitoring. Reports are available to

calculate emissions using AP-42 methodology for any source where gas, coal or oil is burned. You can track emissions history by source or parameter using built-in graphical or statistical analysis. (6)

The Fugitive Emissions Module was designed to

> ...track the testing and inspection information for all equipment (compressor seals, valves, flanges, plugs, etc.) that release fugitive emissions. In addition, this module will aid in calculating SARA 313 TCRR releases by documenting all fugitive emission test points. (6)

The Permits Module was designed to

> ...allow you to create, store information, and monitor the lifecycle of a permit. This module can handle virtually any type of permit (NPDES, POTW, air emissions, construction, etc.). This module can help you keep track of when permits are due to be renewed with Action Item reminders. (6)

EPA Systems. Systems in use by the EPA are usually developed by the research center at Research Triangle Park NC. The air systems researched include the Crosswalk Air Toxic Emission Factor (XATEF) Data Base Management System (DBMS) and the Area and Mobile Source Subsystem (AMS). The AMS is being developed in the current Aerometric Information and Retrieval System (AIRS).

Crosswalk Air Toxic Emission Factor (XATEF) Data Base Management System (DBMS). This system is an IBM PC-based application designed to facilitate the rapid identification and cross-referencing of toxic air pollutant/emission factors for these associations as available (21:1). The main function of the XATEF DBMS is:

> ...to allow an individual to locate and estimate the magnitude of potential air toxic emissions from sources. XATEF may be used to retrieve

> cross-references of pollutants and sources (both general and specific), sets of emission factors, or both pollutant/source cross-references and emission factors. (21:7)

<u>Area and Mobile Source Subsystem (AMS)</u>. This MIS is being developed to replace the National Emissions Data System (NEDS) currently used to calculate, store, and retrieve area and mobile source emissions for certain criteria pollutants (13:2). E. Sue Kimbrough in her article stated:

> With the passage of the Clean Air Act Amendments (CAAA) of 1990 in November 1990, a data system that tracks area and mobile source emissions inventory data becomes critical to the needs of the agency. In particular, an area and mobile source data system will be needed to support the implementation of Title I of the CAAA. (13:2)

"Title I of the CAAA requires that State and local air agencies submit inventory data to support the numerous provisions of the Act" (13:3). The principal focus of the AMS is on supporting Title I with respect to ozone and CO. AMS will have the ability to store area and mobile source emission data and provide reporting, tracking and analytical requirements.

The design intention was to first field AMS on a PC-based system and then on an IBM mainframe with the capability of uploading State data via a batch update process (13:2). The AMS had the possibility of having two paths of information flow, either a 'hybrid' or a 'parallel' approach (13:3). The hybrid approach consisted of the EPA preparing area and source data for all counties in the U.S.

and any State data submitted to replace the EPA data. In the parallel approach, the EPA data would not be replaced but would reside parallel to State data. The parallel approach was selected to implement because of the hybrid's problems and current schedule limitations. The AMS system designers made the basic assumption that no historical data would be loaded because of the potential problems associated with that process. An AMS user has the capability to load data in both the batch or on-line modes. The AMS also supports a variety of output capabilities.

"The AMS source category code constitutes the basic building block of AMS" (13:7). The source category is one of the general data types found in AMS. The major categories of sources include:

> ... Stationary Area Source Fuel Combustion; Transportation; Industrial Processes; Solvents; Storage and Transport; Waste Treatment, Disposal and Recovery; Natural Sources and Miscellaneous Area Sources. (13:7)

The State user identifies whether State data will be used for all counties in that State for each source category. Emission data limits will be defined in AMS as the regulatory limit on emissions as imposed by a Federal, State, or local rule (13:8).

The potential for future enhancements of the AMS are numerous. The ability to support area and mobile source emission inventory reporting activities for PM_{10} and toxic air pollutants is not available. The ability to calculate an emission from an equation rather than a typical value will be added as a later enhancement. The AMS does not support dispersion modeling or simulation at this time.

Developing a Management Information System

This portion of the literature review investigates the various methods used to develop an MIS. Two methods were studied: 1) traditional systems development life cycle, and 2) prototyping. These methodologies were used as a basis for the methodology devised to design the WIMS-ES air module.

Traditional Systems Development Life Cycle. The process of developing a management information system using the traditional systems development life cycle (SDLC) is depicted in Figure 4.

In this approach, each activity is followed in strict sequence and is undertaken only when the previous activity is complete. The preliminary investigation and requirements analysis activities constitute the scope of this thesis and are discussed fully. The final three steps, system design, system acquisition, and system implementation, are not within the scope of the research. The aspect of documentation, which is the tangible result of this thesis, is the final subject discussed in this section.

Preliminary Investigation. The ultimate goal of this activity is to determine the feasibility of developing or modifying an MIS (20:594). The process for this thesis can be divided into three steps as described below.

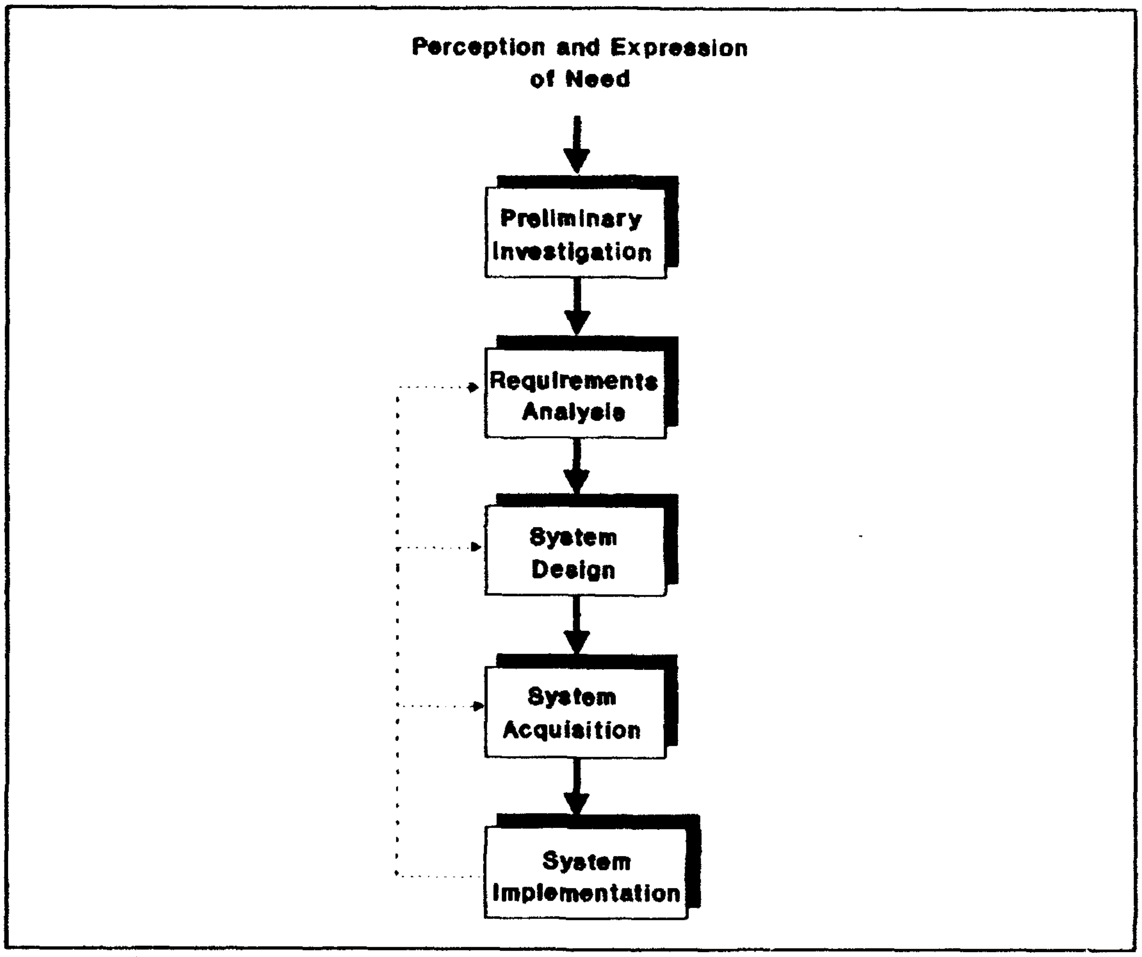


Figure 4. The Traditional SDLC Approach (20:583)

Articulating the Problem. This step involves clearly defining the problem to be solved once the MIS is in place. While defining the problem, the researcher must ensure that all findings are documented in order to justify findings to management. In addition, the researcher must realize that all problems are not completely solvable while completing this process. This way, no false expectations are established (20:594-596).

Determining the Scale of the Project. Once the problem has been articulated, the researcher must decide the scale of the solution to be implemented. With this information, time and dollar requirements can be estimated (20:596).

Determining Viable Options. This step allows the researcher to evaluate each alternative solution. The list of alternative solutions can be limited based on each individual situation (20:597).

Requirements Analysis. During requirements analysis the focus is on determining user needs and studying the applications area in depth (20:598). These aspects of requirements analysis are discussed in the next two sections.

Determining User Needs. To assess needs, the researcher "...must meet with the people who stand to benefit from the system in order to determine what they really require" (20:599). There are four ways to gather the needs of the user: 1) Documents, 2) Questionnaires, 3) Interviews, and 4) Observation (20:599-600).

Documents such as organizational charts, manuals, and reports provide the researcher with objective information. All documents must be checked to ensure they are up-to-date. Questionnaires can gather large amounts of data over a wide area. Various pitfalls such as loaded and leading questions must be avoided. Interviews provide the researcher with in-depth data since respondents can be asked follow-up questions. The language used should remain nontechnical to avoid intimidating the respondent. Observation involves watching potential users perform their tasks. This method was not viable for this thesis.

Analysis of Needs. Once user needs are identified, the researcher must analyze them "...to reach some conclusions" (20:601). One of the best methods to impose order on user needs is diagramming (20:601).

One useful diagram is the data flow diagram (DFD). DFD's "...show graphically how data move within an organization" (20:602). DFD's can be of a general nature and show only critical data or can be very detailed and show each aspect of the process being described (20:602-603). A sample DFD is shown in Figure 5.

Documentation. "Documentation is the term used to describe all types of written instructions associated with using, operating, or developing a computer system" (20:611). The ultimate goal of this thesis was to provide the WIMS-ES design team the documentation necessary to program the air module. There are three types of documentation as outlined below.

Project Documentation. Project documentation chronicles the entire system development effort. All assumptions, system expectations, and practical problems are documented. The purpose of project documentation is to aid future system developers and to justify courses of action followed (20:611).

System Documentation. System documentation is used to show how a certain system operates.

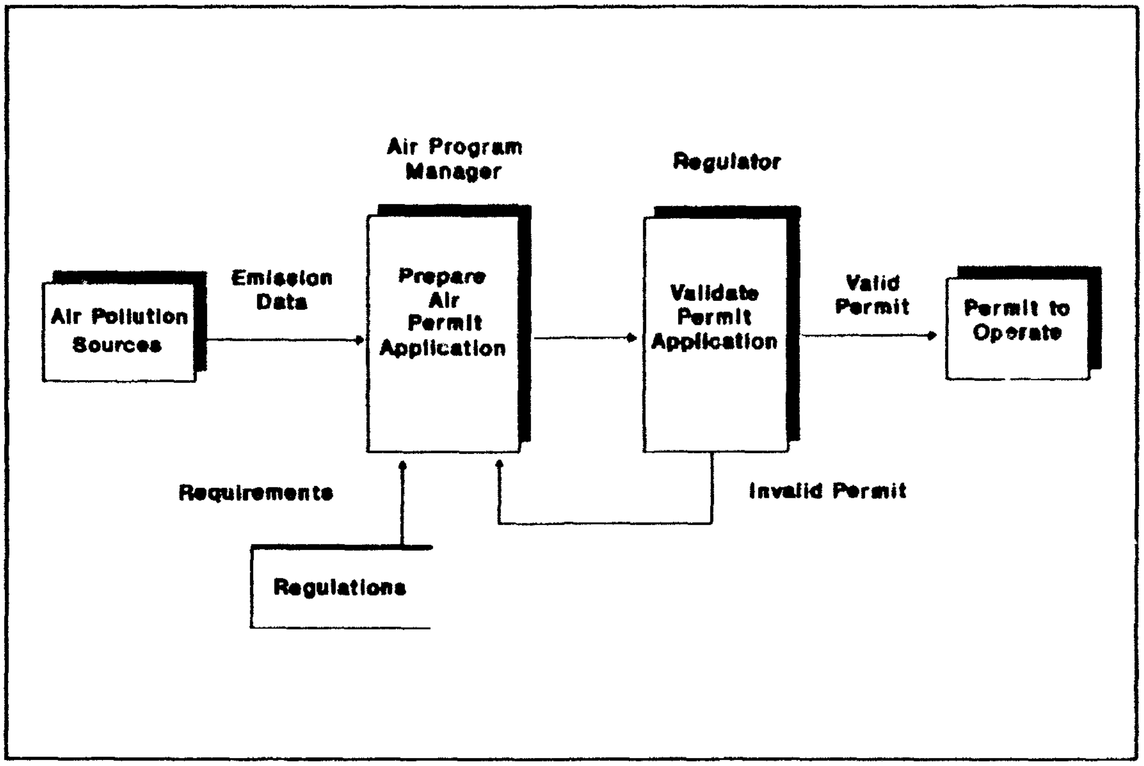


Figure 5. A Sample Data Flow Diagram (DFD) of the Air Permit Application Process

> This includes system requirements, system specifications, diagrams (such as data flow diagrams or system flowcharts), written narratives of job descriptions, and so forth. Parts of this documentation package are especially useful to the programmer, who needs to study how the system works in order to code programs for it. (20:612)

Program Documentation. The three types of program documentation are user documentation, programmer documentation, and operator documentation (20:612-613). Since operator documentation is not within the scope of this thesis, it will not be discussed.

User documentation is prepared to assist the user with using an MIS. The documentation usually consists of a tutorial program and a reference manual. The tutorial steps the user through sample data operations, while the reference manual describes how each command works (20:612).

Programmer documentation is used by the programmer to code the new system into the computer. Some of the most important items in the programmer documentation include a narrative describing the function of the program and each program module, layout forms of input and output data, and a system flowchart depicting the programs, files, and data relations (20:612).

Prototype. The process of developing an MIS using the prototyping method is depicted in Figure 6. With this method, enough requirements are assembled to design a preliminary system, or part of an entire system (20:586). The prototype will usually consist of starter menus, data-entry templates, and report screens (14:588-589). These screens, in most instances, are not connected to a database. This way, the users can experiment, allowing them to make suggestions about the system (20:586).

The system developers then integrate user comments into the mock MIS and re-release it to the users for new comments. This process continues until a final, approved system is developed (20:586). Prototyping is appropriate when

> ...requirements uncertainty is relatively high, the managers requesting the systems often are not sure of their information needs or of the technology capabilities that will most help them, and there is often little or no experience base for the application under development. (20:586)

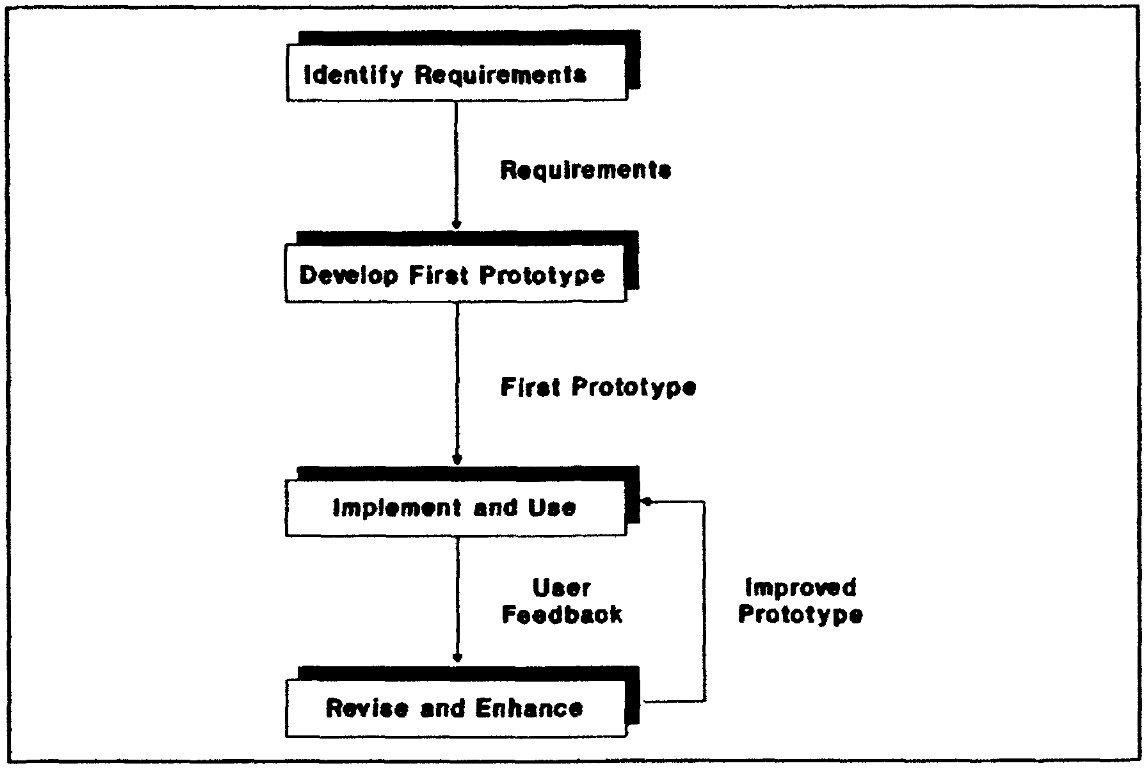


Figure 6. Prototyping (20:587)

SDLC vs Prototype. Each of the two MIS development methods discussed are appropriate for different situations as shown in Figure 7. The characteristics that apply to this thesis are marked with an asterisk.

Summary

Chapter II's purpose was to present background information on the uses of management information systems and literature related to the development of MISs to provide an understanding of the steps involved in developing an air module for the WIMS-ES. The AQUIS and NAETS systems provided the basis for the WIMS-ES air module developed in this thesis. A combination of the SDLC and prototyping

Circumstances favoring traditional SDLC development

- There is significant experience with the type of system to be designed.

* Many important system features can be readily identified before development begins.

* Data requirements can be identified in advance.

* Management requires a comprehensive "picture" of the new system before giving approval.

- The development staff is not experienced with 4GLs or prototyping tools.

Circumstances favoring prototype development

* Users do not have a feel for the information or system capabilities they require.

- User needs are changing rapidly.

* There is little experience with the type of system under development.

* The risk associated with delivering the wrong system is high.

* The way users will react to the new system is an important development variable.

- Many alternative design strategies must be tested.

* The system must be developed quickly and at the lowest possible cost.

Figure 7. Circumstances Favoring the Traditional SDLC and Prototyping Approaches (20:589)

methods were used to gather requirements and validate the final air module. This methodology is detailed in Chapter III.

III. Methodology

Overview

This chapter describes the methodology ultimately chosen to develop the WIMS-ES air module. This methodology consisted of a combination of interviews, literature searches, questionnaires, and a workshop. Each research objective was achieved, providing a contribution to the completion of the air module.

Justification of Methodology

The methodology chosen for this study follows the procedures used by the WIMS-ES design team when developing other WIMS-ES modules. Since the entire thesis effort was worked in conjunction with the design team, it was necessary to follow procedures that they were familiar with. The approach used to develop the air module was outlined in the literature review as a combination of the traditional SDLC and prototyping methods.

Requirements Analysis

Research objectives 1 and 2 were completed during the requirements analysis stage of the methodology. To determine the requirement of an Air Force air pollution management system (research objective 1), a literature review of other air pollution MISs was conducted along with interviews of Air Staff environmental staff members. The literature review also identified features of air pollution

MISs currently used in the DoD, the EPA, and industry (research objective 2).

Develop Air Module Implementation Plan

The next step in the methodology was to develop an air module implementation plan and present it to the Air Staff for approval (research objective 3). The plan was to be developed from the information gathered in the requirements analysis stage outlined above, and verified with the WIMS-ES design team. In the end, the Air Staff mandated an implementation plan. This event will be explained further in Chapter 4.

Design WIMS-ES Air Module

The air module was designed (research objective 4) after the requirements were gathered and the implementation plan was approved. An attempt was made to fulfill each known requirement with the initial design of the module. Once the draft module was complete, it underwent the following validation process.

Air Staff Review. The air staff reviewed the initial module upon completion. They provided comments which were integrated into the design and also defined the scope of the final module.

Air Force Review. The prototype air module was then sent to various air program managers along with the questionnaire described below.

Potential Population and Sample. The potential population for the questionnaire consisted of the air program managers at all installations and levels within the Air Force. The installations include both Continental United States (CONUS) and overseas active and reserve facilities. The levels where air program managers are employed include the Air Staff, the Air Force Center for Environmental Excellence (AFCEE), Regional Compliance Offices (RCOs), MAJCOMs, and the installations. Since the Air Staff's input was already accounted for, they were not sent a questionnaire.

A nonprobability judgement sample was chosen. A judgement sample is one in which "the researcher handpicks sample members to conform to some criteria" (5:275). The first selection criteria was to include active CONUS installations, since they are the users of the WIMS-ES. Other criteria are described below for air managers at each level.

AFCEE. The AFCEE provides all Air Force bases with technical expertise in the field of environmental management. The air program manager was included in the sample because of his broad view of the Air Force's air program.

RCO. The RCO acts as a liaison between Air Force bases and the EPA to help resolve regulatory problems. There are three RCOs, located in Atlanta, Dallas, and San

Francisco. The Dallas RCO air manager was included in the sample.

MAJCOMs. Two MAJCOM headquarters air program managers are in the sample. Air Combat Command (ACC), and Air Mobility Command (AMC) were chosen because of their diversity of bases and proximity to the researchers.

Bases. Individual bases were chosen for the sample based on their stringent regulatory environment. If the requirements of bases with numerous pollution source categories and/or stringent air pollution regulatory requirements were met, then the requirements of all bases would be met. The following bases were chosen for the sample.

1. March AFB, CA
2. Eglin AFB, FL
3. McClellan AFB, CA
4. Tyndall AFB, FL
5. Tinker AFB, OK
6. Langley AFB, VA
7. Mountain Home AFB, ID
8. Vandenburg AFB, CA
9. Kelly AFB, TX

Instrument Development. The main portion of the instrument was the air module prototype itself. Program managers were sent the prototype along with a questionnaire (Appendix A) which asks for comments concerning each section of the prototype.

Data Collection Plan. Questionnaires were sent to the air program managers mentioned as part of the sample. Respondents were given two weeks to return the questionnaires.

Data Analysis. Each of the respondents' comments were reviewed for inclusion in the module. Obvious improvements were included immediately. Other comments were presented at the working group described in the next section.

Air Module Workshop. The Air Staff planned a workshop to validate the air module, along with other WIMS-ES modules (Appendix D). The workshop allowed experienced air program managers to interact and make final adjustments to the air module. During the workshop, comments from the questionnaires were presented for inclusion in the module.

IV. Results and Discussion

Overview

This thesis consisted of two distinct research tasks. The first task was to fulfill a series of research objectives. Upon completion of these tasks, a draft air module for the WIMS-ES was developed. The second research task was to validate the air module so it could be released for Air Force-wide use.

This chapter discusses the results of both research tasks. First, findings as they relate to each research objective will be provided. Then, the air module validation process will be outlined.

Research Objectives

Each of the four research objectives, along with their respective findings, are provided in the following paragraphs.

Research Objective One. Determine the requirements of an Air Force air pollution management information system.

Many of the requirements of an air pollution MIS were previously researched by the team that developed AQUIS. An analysis of AQUIS showed how these requirements were translated into an MIS. The AQUIS program provides ALCs a tool to document a source inventory and track associated permits, control equipment, and emissions. Further requirements were acquired from the Air Staff in interviews conducted on 27 and 28 March (17). The Air Staff's first priority was to develop a system that each base could use. This meant designing the air module with fields that were generic to the entire Air Force. The Air Staff also required a networked system. Air pollution information for each base had to be accessible from the Air Staff and the base's parent headquarters. The Air Staff did not have any specific reporting requirements concerning air pollution. Instead, they wanted enough data available that they could extract information on a variety of air pollution aspects incluuing emissions, permits, sources, and costs. Figure 8 is a consolidated list of the requirements for an Air Force air pollution MIS.

1. Store and track a source inventory.
2. Maintain air permit data.
3. Store and track emissions data.
4. Store and track control equipment data.
5. Generate reports.
6. Telecommunication networking.

Figure 8. Air Force Air Pollution MIS Requirements

<u>Store and Track a Source Inventory</u>. This requirement was widely documented (3:2-18, 9:6). A source inventory is the heart of an installation's air pollution management program. The source inventory lists each

equipment item on a base that emits air pollutants. A full description of each source should also be included. Regulatory agencies govern which items must be accounted for in a base's inventory.

Maintain Air Permit Data. Once Title V of the CAAA is implemented, all bases will be emitting air pollutants under the authority of an air operating permit. Air permit programs vary from state to state, but all bases must have the ability to track permit data and costs. The costs will then be reported through the A-106 process.

Store and Track Emissions Data. Emissions from each base must be reported to the governing regulatory agency. The air module must be able to track emissions of the criteria pollutants, along with a variety of hazardous air pollutants (16:93).

Store and Track Control Equipment Data. Since most permit applications require a description of each piece of control equipment, the module needed an area to handle this information (16:95). Control equipment maintenance could also be tracked here.

Generate Reports. This requirement is inherent throughout the entire WIMS-ES (23). Reports are necessary to extract information from the air module database.

Telecommunication Networking. This requirement was already identified as a part of the WIMS-ES, and the Air Staff did not want to deviate toward the use of a stand alone PC-based program just for the air module (17).

Research Objective Two. Identify features of air pollution MISs currently being used in the DoD, the EPA, and industry.

Table 1 shows the various features found in the air pollution MISs researched. The bold features are those required by an Air Force air pollution MIS.

TABLE 1

AIR POLLUTION MIS FEATURES

	Source Inventory	**Permit Data**	Air Modeling	Emission Calculator	**Control Equip**	**Emission Data**	**Reports**	**Networked**
AQUIS	*	*	Partial	*	*	*	*	
NAETS	*	*		*		*	*	Partial
MPS	*	*		*	*	*		
ENFLEX	*	*		Partial	*	*	*	
XATEF	*			*		*		
AMS	*			*		*	*	*

The AQUIS, NAETS, MPS, and ENFLEX systems met all but the networking requirement for an Air Force air pollution MIS. Initially, none of these systems were anticipated to be directly copied and used for Air Force-wide air pollution management; however, if the AQUIS could be networked (i.e. transitioned to the WIMS-ES from PCs), the program had the potential to function as the air module. This option would have left very little work for this research project.

Research Objective Three. Develop and recommend an air module implementation plan to the Air Staff.

The Air Staff made this research objective quite simple. On 27 March 92, the researchers proposed using a conversion program to adapt AQUIS to the WIMS-ES as a possible air module. Since AQUIS was already developed and being used at the five ALCs, this seemed like a viable option. On 31 March 92, Colonel Bartell (USAF HQ/CEVC) decided that a separate air module would be designed on the WIMS-ES without links to any other air pollution MIS, including AQUIS (24). After looking at AQUIS, his staff saw it as too technical for Air Force-wide use. The program was, after all, developed for ALCs with hundreds of sources. Also, the Air Staff wanted each module of the WIMS-ES to look and operate in a similar manner. This would allow environmental managers to use all modules with minimal training. Now with a defined scope, the Air Staff designated implementation dates for the air module as shown in Table 2 (25). Using these milestones as a firm guideline, the next step was to develop the actual air module.

Research Objective Four. Upon approval of the implementation plan, design Phase I of the air module.

The first draft of the air module had to be prepared in eight weeks. Using the information gathered in research objectives one and two, a series of four programs were designed: 1) source information, 2) permit information,

TABLE 2

AIR MODULE MILESTONES

Milestones	Date
Draft Air Module	1 May 92
Final Air Module	1 Jun 92
Programming of Air Module	Jul - Aug 92
Full Implementation	Dec 92

3) control equipment, and 4) emissions. The draft flowchart for the air module is shown in Figure 9. With this data arrangement, each program could be accessed from any one of the other programs. This arrangement was slightly flawed, but was corrected during the validation process. The draft flowchart placed the air module within the WIMS-ES compliance menu. As a starting point in the module, Carol Roark, WIMS-ES design team member, suggested using a "Base Air Overview" screen. From there, the user could enter a source and add any relevant control equipment, source emission, or permit data. The air module was intended to be linked to the A-106 and quarterly report modules.

The remainder of this section contains the screens used in the draft air module along with a description of their functions. The entire program underwent changes during the validation process which are described in the validation section of this chapter. A data dictionary that describes

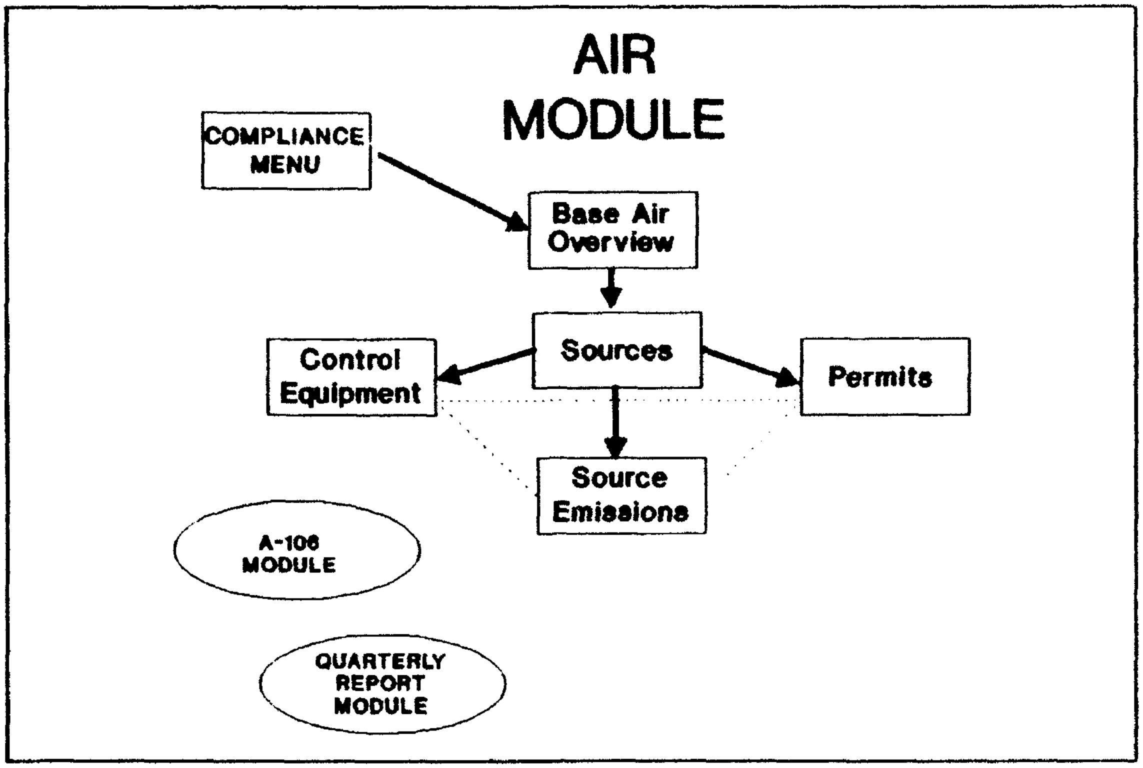


Figure 9. Draft Air Module Flowchart

each field in the final module is included as Appendix B. Data dictionaries for the draft and intermediate modules are not included.

Draft Base Air Overview Program. This program's goal (Figure 10) was to provide headquarters personnel a quick glance at the current status of a base's air program. The screen could also be used by those on base not directly involved with the day to day business of air management. The Air Staff Environmental Planning section suggested recording a base's attainment status somewhere in the module (22), thus an attainment matrix was developed and placed on the overview screen. The "Air Emergency Episode Plan" field was a result of an Environmental Compliance and Assessment

Management Program (LCAMP) protocol requirement (3:2-19). The other fields pull information from the entire module and consolidate it on this screen.

```
          AIR QUALITY MANAGEMENT - OVERVIEW OF BASE AIR
                                         Date of Last Update **** ** **
MAJCOM ***          Base *******            State **       EPA Region **

Total Number of Notice of Violations (NOVs)   ***
Total Number of Compliance Agreements (CAs)   ***
Air Emergency Episode Plan   *         Date **** ** **
                                Type of Attainment Area
                PM        SO2        NOX        OZONE        CO        LEAD
Mild            *          *          *          *           *          *
Moderate        *          *          *          *           *          *
Serious         *          *          *          *           *          *
Severe          *          *          *          *           *          *
Extreme         *          *          *          *           *          *

Air Quality Control Region   *
Total Number of Emission Sources   ****
Total Number of Permits    PSD ***    State ***    Local ***
Total Permit Costs  $ ******
Total Number of Control Equipment Items  ****
```

Figure 10. Draft Base Air Overview Screen

<u>Draft Source Information Program</u>. The source information screen (Figure 11) forms the basis for a source inventory. Each source is entered as a separate record. Then, depending on the source category, further information concerning the source could be placed in a specific "Source Data" screen. The individual "Source Data" screens are located in Appendix C. The source data information was intended to be used for an emission calculation system. The source categories were adapted from the AQUIS data

dictionary and expanded throughout the development process. Physical location and parameters are standard permit requirements and were included on the source information screen (2:4). The source identification number was initially going to be a 5-digit code sequentially assigned by the computer as sources were loaded into a base's inventory. This field was later changed during the validation process.

```
              AIR QUALITY MANAGEMENT - SOURCE INFORMATION
                                        Date of Last Update **** ** **
MAJCOM ***         Base *******            State **       EPA Region **
Source ID Number *****                 Source Category ***************
Facility         ***** **              Source Type     ***************

Source Description ***************************************************
**********************************************************************

Owner ************        POC ***************         Phone *************

Exhaust Ventilation Type **********     Other **********
Manufacturer *************** Make ***************
Serial Number *************** Model ***************
EPA Source Classification ************
Date Installed **** ** **                          Associated Projects *
Operational Status *                                 Control Equipment *
Type of Permit Required **************                             NOV *
```

Figure 11. Draft Source Information Screen

<u>Draft Permit Information Program</u>. This program allows the user to track construction or operating permit data. Since permits can be issued by the county, district, state, or federal EPA, these screens could not be formatted

based on individual forms. The generic screens do, however, contain the most common fields found on various air permits studied.

Screen One. Figure 12 shows Draft Permit Information Screen One. This screen records basic data about each permit and tracks the costs associated with the permit over three fiscal years. The types of fees shown may not be used by all permitting agencies, but the variation of fields shows the versatility of the program.

```
                 AIR QUALITY MANAGEMENT - PERMIT INFORMATION
                                        Date of Last Update **** ** **
MAJCOM ***         Base *******            State **       EPA Region **
Source ID # *****  Facility ***** **  Source Category ***************
                                      Source Type     ***************

Permit Type:    PSD *   State *   Local *        Permit Status *
In Compliance with Permit *
Permit to Install # *************       Registration # **************
Permit to Operate # *************       Application #  **************
Issuing Agency ************** POC ************** Phone *************
Fiscal Year            ****              ****                ****
Application Fee        *****             *****               *****
Installation Fee       *****             *****               *****
Operating Fee          *****             *****               *****
Variance Fee           *****             *****               *****
Certification Fee      *****             *****               *****
Renewal Fee            *****             *****               *****

Total Fees             ******            ******              ******
```

Figure 12. Draft Permit Information Screen One

Screen Two. This screen is shown in Figure 13. It tracks the various milestones with any construction or operating permit. The fields can be used to generate reports based on upcoming due dates. Both Draft Permit Information Screens Two and Three were designed to be automatically attached to Screen One as an entire permit record.

```
                AIR QUALITY MANAGEMENT - PERMIT INFORMATION
                                        Date of Last Update **** ** **
Source ID # *****  Facility ***** **   Source Category ***************
                                       Source Type     ***************

                     ASSOCIATED PERMIT MILESTONE DATES

Original Permit Application Date                       **** ** **
Permit to Install Issue Date                           **** ** **
Date Agency Notified That Installation was Complete    **** ** **
Original Permit to Operate Date                        **** ** **
Latest Date Permit Amended                             **** ** **
Latest Date Permit Reissued                            **** ** **
Effective Date of Latest Reissue                       **** ** **
Date for Permit Inspection/Testing                     **** ** **
Date Permit Expires                                    **** ** **
Date Renewal Required                                  **** ** **
Date Renewal Submitted                                 **** ** **
```

Figure 13. Draft Permit Information Screen Two

Screen Three. Figure 14 shows Draft Permit Information Screen Three. The screen records specific operating guidelines outlined in the governing regulations and specified on the source's operating permit. These items can be quite extensive, but the screen's intent was to record only the highlights of each requirement, not the entire verbiage.

```
                AIR QUALITY MANAGEMENT - PERMIT INFORMATION
                                         Date of Last Update **** ** **
Source ID # ***** Facility ***** **     Source Category ***************
                                        Source Type     ***************

                     PERMIT APPLICABLE REGULATIONS
Waivered: *  Variance: *

Regulatory Emission Limits:******************************************
            *********************************************************
            *********************************************************
Regulatory Operating Conditions:*************************************
            *********************************************************
            *********************************************************
Specified Emission Limits:*******************************************
            *********************************************************
            *********************************************************
Specified Operating Limits:******************************************
            *********************************************************
            *********************************************************
```

Figure 14. Draft Permit Information Screen Three

<u>Draft Control Equipment Program</u>. The air manager can use this program (Figure 15) to track information on control equipment. Besides a physical description, there are fields to record the types of pollutants controlled. The six "other" fields allow the user to record hazardous air pollutants in addition to the criteria pollutants. Each control equipment item record is attached to its parent source record. Like the permit program, this link is established by entering the source identification number on the control equipment record. The program allows for a source to have multiple control devices.

<u>Draft Emissions Program</u>. This program (Figure 16) is used to record a source's emissions. Each source will

```
                 AIR QUALITY MANAGEMENT - CONTROL EQUIPMENT
                                         Date of Last Update **** ** **
MAJCOM ***        Base *******              State **      EPA Region **
Source ID Number *****                   Source Category ***************
Facility          ***** **               Source Type     ***************

Control Equipment Type ********************
Describe if Other *************************
Purpose of Equipment *********
Control Description ************************************************
*********************************************************************

Manufacturer  ***************   Make  ***************
Serial Number ***************   Model ***************
Operational Status ********         Initial Operation Date **** ** **
Pollutants Controlled:  Particulates *   SO2 *   VOC *   CO *   NOX *
                      Other ****** ****** ****** ****** ****** ******
```

Figure 15. Draft Control Equipment Screen

have a "set" of associated emission records since only one emission type can be entered per record. The "Emission Type" field is selectable, with the choices being the criteria pollutants or hazardous air pollutants. Although the new hazardous air pollutant regulations are not yet in effect, the program was designed to handle these pollutants. The original intent was to allow the user to select a hazardous air pollutant from the Chemical Hazard Response Information System (CHRIS) listing, which is maintained as a separate database in the WIMS. This proposal was later changed during the validation process.

```
                   AIR QUALITY MANAGEMENT - EMISSIONS
Source ID # *****  Facility  ***** **  Date of Last Update **** ** **
Source Category ***************

                                EMISSIONS    FY ****              Specified
Emission Type    Method   LB/Hr(Max)  LB/Day    Tons/Yr    Tons/Yr
****************   *        ****       *****     ****       ****


Comments:***********************************************************
         ***********************************************************
         ***********************************************************
```

Figure 16. Draft Emissions Screen

Air Module Validation

The next step in the thesis methodology was to validate the air module. The validation process consisted of a series of reviews that converted the draft air module into a finalized air module. The final air module was then sent to the WIMS-ES programmers for coding.

Air Staff Review. An Air Staff review was the first step in the validation process. Their comments established a final scope for the module, along with some changes to the programs themselves. Figure 17 summarizes the modifications made by the Air Staff during a conference on 14 May 92 (18).

Changes 1 and 2 were made by Air Staff in an effort to save coding time. Since the module needed to be programmed

1. Eliminate the link between the quarterly reporting module and the air module.

2. Eliminate all sublinks within the air module except that between the source information and permit information programs.

3. Eliminate the additional "Source Data" screens.

4. Do not include an emission calculations feature in the air module.

5. Eliminate Permit Information Screen Three.

Figure 17. Air Staff Modifications

by August 1992, the Air Staff felt the links did not justify the possibility of a delay in fielding the program. The Air Staff deleted the emission calculation capability (Changes 3 and 4) for two reasons. First, the air module was intended to be an MIS, not a technical tool. Emission calculation capabilities crossed that line and added additional coding for mathematical formulas. Second, an emission calculator would need an update every time a calculation was revised. This occurs frequently as new emission estimating methods are constantly being developed by the scientific community (10). Change five was made because the Air Staff saw the permit regulation information as unnecessary, and no reports could be generated from this screen.

Air Force Review. The second step in the validation process involved gathering comments and suggestions from air program managers around the Air Force. Thirteen air program managers were sent the second draft air module (after Air

Staff comments) as described in Chapter III. The entire questionnaire package is attached as Appendix A.

Nine of the thirteen questionnaires were returned. McClellan, Tyndall, Langley, and Vandenburg AFBs did not provide responses. Since a workshop was going to be held on 1 and 2 July 92 to finalize the air module, the researchers did not conduct a follow-up with the non-respondent bases. A summary of the changes made in the module as a result of the questionnaires is shown in Figure 18. Overall, the responses were positive and very few modifications were suggested.

1. Add "Water Injection on Jet Engine Test Cell" and "Fabric Filter" as control device choices.

2. Add "Oil/Water Separators" and "Wastewater Treatment" as source category choices.

3. Separate underground and aboveground storage tanks as source category choices.

Figure 18. Air Force Questionnaire Modifications

Air Module Workshop. The final step in the validation process was a workshop with Air Force air program managers. The goal of the workshop was to gain multi-level approval of a finalized version of the air module.

Carol Roark, WIMS-ES design team member, conducted the workshop, which was arranged by the Air Staff. Ms. Roark, as facilitator, presented each program of the air module to the workshop members for review and comment. No major disagreements occurred throughout the process and the members approved a finalized version of the air module within six hours. Figure 19 shows a listing of the workshop members.

Workshop Member	Office Symbol
Major Tim Middleton	HQ USAF/CEVC
Mr. Larry Isaacs	HQ ACC
Mr. Nick Linden	RCO (Dallas)
Mr. S. James Ryckman	HQ AFMC
Mr. Ed Hess	2750 ABW/EM
Captain Robert Cantwell	AFIT/ENV
Captain Jonathan Davis	AFIT/ENV
Ms. Carol Roark	HQ AFMC
Mr. Ed Carpenter	HQ AFMC
Mr. Gary Muller	HQ AFMC

Figure 19. Air Module Workshop Members

Final Air Module

The final air module flowchart is shown in Figure 20. This version is a result of the validation process previously described. The workshop members adjusted the data flow so that a single permit that governs several sources could be entered. The remainder of the data flow was unchanged. The following paragraphs display the final program screens along with a description of the modifications made at the air module workshop.

General Modifications. The workshop committee made four changes that applied to each program. First, the "Source Type" field was deleted from the screens since it is

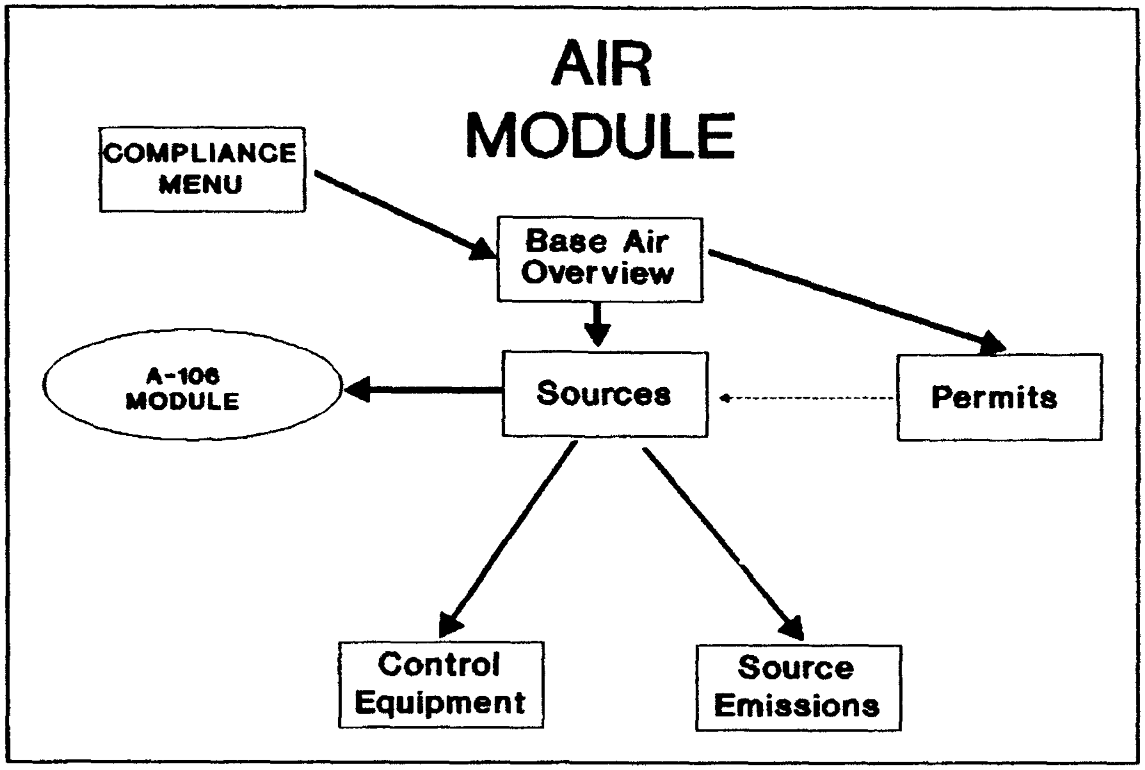


Figure 20. Final Air Module Flowchart

not used by the regulators or the Air Force. Second, a "County" field was added throughout the module. This was necessary because many regulatory agencies govern air emitters on a county basis. The third modification added an "other" field to the screens to allow for any unusual circumstances not accounted for with the given fields. The last change was to add comment blocks to each screen. This allows each program manager to record special information not recorded within the fields.

<u>Final Base Air Overview Program</u>. Figure 21 displays the Final Base Air Overview Screen. The workshop committee first corrected errors in the attainment matrix. The nonattainment status "Mild" is actually "Marginal" and the

"Severe" status has been divided between "Severe 15" and "Severe 17." This distinction refers to the number of years a non-attainment area has to reach attainment. Another screen modification included a change to the "Air Quality Control Region" field. Since all bases are located within an AQCR, this field became a 3-digit code as opposed to a yes/no field. The 3-digit AQCR codes are issued by the EPA.

```
                    OVERVIEW OF BASE AIR PROGRAM
                                   Date of Last Update **** ** **
MAJCOM *** Base ********* State ** County ************* EPA Region **

Air Emergency Episode Plan?         *        Date **** ** **
Transportation Management Plan?     *        Date **** ** **
Completed Air Emission Inventory?   *        Date **** ** **
                      Certified?    *        Date **** ** **
Air Quality Control Region          ***      Enforcement Actions? *

                  Type of Federal Nonattainment Area
               PM10      SO2       NOX       OZONE       CO      LEAD
Marginal                            *          *
Moderate        *                   *          *          *
Serious         *                   *          *          *
Severe 15                           *          *
Severe 17                           *          *
Extreme                             *          *
In Attainment?  *         *         *          *          *        *

Base Air Program Mgr ******************  DSN *** ****
```

Figure 21. Final Base Air Overview Screen

The members added several fields to the overview screen. The first was a "Transportation Management Plan" field. This plan is related to mobile source air emissions and will become more important as Title II of the CAAA is implemented. A "Certified" field was added to the source inventory section to indicate if the source inventory has been certified by a base official. The workshop members also added a "Base Air Program Manager" field to this screen. All of these additions were made to aid headquarters personnel or inspection staffs with gaining a cursory look at a base's air program.

The committee also made deletions to this screen. The "Notice of Violations" and "Compliance Agreements" fields were removed since this information can be found in the quarterly report module. All permit and control equipment information fields on the overview screen were removed also. These fields were viewed as unnecessary.

Final Source Information Program. The Final Source Information Screen is shown in Figure 22. The committee made only minor adjustments to this program. The most noteworthy was making the "Source ID#" assignable by the user, as opposed to a computer-assigned identification number. This change was made to accommodate those bases that have already assigned identification numbers to their sources and to allow flexibility to bases that want to correlate facility numbers and source identification numbers somehow.

The committee deleted the "Associated Projects," "Control Equipment," and "NOV" fields. These fields did not provide any additional reporting capabilities or information not available elsewhere in the WIMS-ES.

```
                         SOURCE INFORMATION
                                     Date of Last Update **** ** **
MAJCOM *** Base ******* State **  County *************  EPA Region **

Source ID # *****  Source Category **********  Facility # ***** **

Source Title *******************     Permit Requirement **********
Operational Date       **** ** **    In Use?                     *
Install/Construct Record #  ****     Operate Record #         ****

Manufacturer  *************************       Make  ***************
Serial #      *************************       Model ***************
Exhaust Ventilation **********  If other, describe ***************
Control Equipment?         *

Source Description ***********************************************
*****************************************************************
Owner ************     POC ***************      Phone *** *** - ****
Comments ********************************************************
*****************************************************************
*****************************************************************
```

Figure 22. Final Source Information Screen

<u>Final Permit Information Program</u>. The two Final Permit Information Screens are shown in Figures 23 and 24. Two fundamental modifications to this program occurred during the workshop. First, each permit screen received a "Record" field. This field was necessary to create a link between a permit record and at least one source record. The committee viewed this as mandatory since many permits cover more than one source. The second change concerned the cost tracking feature. Although the Air Force tracks costs on a fiscal year basis, regulatory agencies levy permit fees on a calendar year basis. Thus, the permit fees section was adjusted to accommodate calendar years. Actual dollars

spent or budgeted on a fiscal year basis can be reported in the A-106 module.

```
                           PERMIT INFORMATION
                                     Date of Last Update **** ** **

MAJCOM *** Base ******** State ** County *************  EPA Region **
Record # ****                     Permit Title ******************
Permit # ********************     Application # **************
Issue Authority******* Type Permit******* Permit Status******** PSD?*
Regulator's POC ******************  Phone       *** *** ****

                   CY ****       CY ****       CY ****      CY ****
Application Fee  $ *********   $ *********   $ *********  $ *********
Installation Fee $ *********   $ *********   $ *********  $ *********
Operating Fee    $ *********   $ *********   $ *********  $ *********
Variance Fee     $ *********   $ *********   $ *********  $ *********
Certification Fee$ *********   $ *********   $ *********  $ *********
Renewal Fee      $ *********   $ *********   $ *********  $ *********
Other            $ *********   $ *********   $ *********  $ *********
TOTAL FEES       $ *********   $ *********   $ *********  $ *********

Comments *********************************************************
******************************************************************
```

Figure 23. Final Permit Information Screen One

<u>Final Control Equipment Program</u>. This program's final screen is displayed as Figure 25. The workshop members added three fields to this program. First, a "Particulates < 10" field was added to the choices for the types of "Pollutants Controlled." Second, the committee included an "Efficiency" field. Efficiency indicates to what degree the control equipment item controls a particular pollutant, and is usually used on a permit application. The last change was the addition of a "Preventative Maintenance #" field. The in-house maintenance personnel use these numbers to

```
                         PERMIT MILESTONES
                                     Date of Last Update **** ** **
MAJCOM   ***   Base ********
Record # ****  Permit # *******************   Type Permit *******

                          MILESTONE DATES
      Original Permit Application                      **** ** **
      Issued Permit to Install                         **** ** **
      Agency Notified of Completion                    **** ** **
      Original Permit to Operate                       **** ** **
      Last Amendment                                   **** ** **
      Reissued                                         **** ** **
      Effective Date of Reissued Permit                **** ** **
      Permit for Inspection/Testing                    **** ** **
      Permit Expires                                   **** ** **
      Renewal Required                                 **** ** **
      Renewal Submitted                                **** ** **
      Other: ********************                      **** ** **

Comments ***********************************************************
********************************************************************
```

Figure 24. Final Permit Information Screen Two

track maintenance dates and work performed for an individual equipment item. The air manager must ensure that preventative maintenance occurs on schedule so that design efficiencies are maintained and the base remains in compliance.

Final Emissions Program. The emissions program underwent numerous changes as a result of the workshop. Its screen is shown in Figure 26. The most significant change was in the emission matrix. The program was adjusted to record a source's emission of each pollutant over four calendar years. The matrix also allows the air program manager to select which units are being used to measure each pollutant.

```
                         CONTROL EQUIPMENT
                                        Date of Last Update **** ** **

MAJCOM *** Base ******* State **  County *************  EPA Region **
Equip ID #      ******  Facility #       ***** **
Control Equip Type *************** If other, describe ***************
Purpose of Equipment * Equip Status ***** Initial Op Date **** ** **

Pollutants Controlled: Particulates * Particulates<10 *  SO2 *  VOC *
                       CO *   NOX *  Other ****** ******
Efficiency ******** %  Preventative Maintenance # ******

Manufacturer  *************************      Make  ***************
Serial #      *************************      Model ***************

Comments ************************************************************
*********************************************************************
```

Figure 25. Final Control Equipment Screen

The manner by which "Emission Type" is indicated was changed also. The draft emission program allowed the user to select a criteria pollutant or a hazardous air pollutant from the CHRIS database. Unfortunately, the selections in the CHRIS database were not appropriate. The final program allows the user to select a criteria pollutant or an "other" if the pollutant is hazardous. The hazardous pollutant is then described in the "Pollutant" field and its associated Chemical Abstract Services (CAS) number is entered in the "CAS #" field. This way, reports can still be generated based on emission type using the "CAS #" or "Emission Type" fields.

```
                              EMISSIONS
                                         Date of Last Update **** ** **

MAJCOM *** Base ******** State **  County ************* EPA Region **
Emission ID# ******* Source Category************** Facility#***** **
Emission Type ********** CAS#************** Pollutant**************
Method *********

Are there emission controls for this pollutant?  *
If yes, indicate efficiency                   ********* %

           CY ****          CY ****          CY ****          CY ****
       Monthly Annual   Monthly Annual   Monthly Annual   Monthly Annual
Permit   *****  *****     *****  *****     *****  *****     *****  *****
Actual   *****  *****     *****  *****     *****  *****     *****  *****
Units   ****** ******    ****** ******    ****** ******    ****** ******

Comments ***********************************************************
********************************************************************
********************************************************************
```

Figure 26. Final Emissions Screen

Like the control equipment program, the emissions program received fields to document control efficiency information. The committee thought this redundancy would aid in the permit application process by providing the air manager with a dual check on emission control data.

The final modification to the emissions program was the addition of an "Emission ID#" field. The emission identification number is based on the source identification number entered in the source program. Since each source may have many emission types, the emission identification number must serve as the link between the two programs.

Summary

This chapter outlined the entire research effort required to develop the final air module for the WIMS-ES. The methodology required the use of literature reviews, interviews, questionnaires, and a workshop. Each method contributed to the research outcome. The questionnaire, however, yielded the least amount of information. This may be attributed to the quick turnaround time required or to the evaluation method used. Questionnaire respondents may have found it difficult to evaluate an MIS based on printed data screens and data dictionaries. The workshop, on the other hand, proved to be a valuable tool. The structured climate combined with evaluator interaction allowed for a thorough validation of the air module.

V. Summary, Conclusions, and Recommendations

Summary

The objective of this thesis was to apply a management information system design technique to the management of air pollution in the Air Force. The overall goal was to develop an air module for the WIMS-ES that the Air Force environmental community could use to better track and analyze air pollution data. Experts in the Air Force's environmental field provided information about data management requirements. This information, combined with the knowledge gained from analyzing existing air pollution MISs, allowed for the draft design of the WIMS-ES air module. The draft air module was then validated through the use of an Air Staff review, an Air Force review, and a hands on workshop with Air Force air program managers. The final air module has been forwarded to the WIMS-ES programmers at HQ AFMC, and should be distributed across the Air Force by December 1992.

Conclusions

During this thesis project, four research objectives were met. The final product, the WIMS-ES air module, was developed and forwarded to the WIMS-ES design team for implementation. Several conclusions can be drawn as a result of this research.

An Air Force air pollution MIS must be able to track air pollution sources and their associated permits, emissions, and control equipment. In addition, the system must be linked throughout the Air Force with report generating capabilities at each level (base to Air Staff).

Several air pollution MISs were analyzed prior to the air module's development. AQUIS, a system designed for use at Air Logistics Centers, was found to fit most of the Air Force's needs. AQUIS's biggest drawback was its incompatibility with the other WIMS-ES modules. This prevented AQUIS from being actively linked from bases to their headquarters. AQUIS did however, provide some good development ideas for the final WIMS-ES air module.

The Air Force is ready for environmental data automation. Bases are just beginning to feel the effects of the 1990 CAAA. The WIMS-ES air module will be in place to help air program managers deal with the far reaching requirements of this legislation. The air module may never be perfect. But, it was built with flexibility in mind. Following are some ideas for further study regarding the WIMS-ES air module.

Recommendations

Recommendations for further work focus on two areas. The first is an analysis of the air module's use in the field. The second is a study of further air module developments.

Air Module Use. The new air module will prove to be a valuable tool for air program managers. But its effectiveness will depend on the capabilities of an active air program manager with the proper software training. A study could focus on how air managers are using the air module in the field. This could be done in conjunction with an effectiveness evaluation. Does the system save time and/or ease the administrative burden on air program managers? What is the regulator's view of the system? Questions like these could probably not be answered until the system is in use for a least one year.

Air Module Development. The air module may be expanded in many ways. As mentioned in Chapter IV, the draft air module included source screens that were to be used to calculate emissions. This idea could provide a valid research project. Calculating emissions with the WIMS-ES, or in conjunction with other software packages, may prove to be an excellent improvement to the air module.

Another possible air module expansion involves developing an interface with regulator databases. This data exchange would allow for electronic reporting of emission inventory information between a base and its regulator. The AQUIS development team has done some background work along these lines which may be adapted to the WIMS-ES air module (27:14).

The air module may also be connected to continuous emission monitors or field personnel responsible for recording emission information. Through the use of a modem and supporting software/hardware, the air module could gather data without the direct involvement of the air program manager. This type of automated system will be necessary as manpower dollars continue to fall while the list of environmental requirements grows.

Appendix A: Air Module Questionnaire Package

From: AFIT/ENV 8 Jun 92

Subject: WIMS-ES Air Module

To: Air Program Manager

In 1989, the Air Staff directed the Air Force Logistics Command (now Air Force Materiel Command - AFMC) to oversee the development of the Work Information Management System - Environmental Subsystem, better known as the WIMS-ES. The WIMS-ES consists of various modules to assist the Air Force with managing environmental data.

The development team identified an air module as a necessary component of the WIMS-ES. As environmental graduate students at AFIT, we are developing the air module as our thesis project. The draft air module has already been accepted by the Air Staff, and now we are soliciting comments and suggestions from base and headquarters level air program managers.

Enclosed is a copy of the draft air module program, including a data flow chart, the screens, a general information sheet, and an abbreviated data dictionary. An informal questionnaire is also included. Please review the program and provide your comments on the questionnaire.

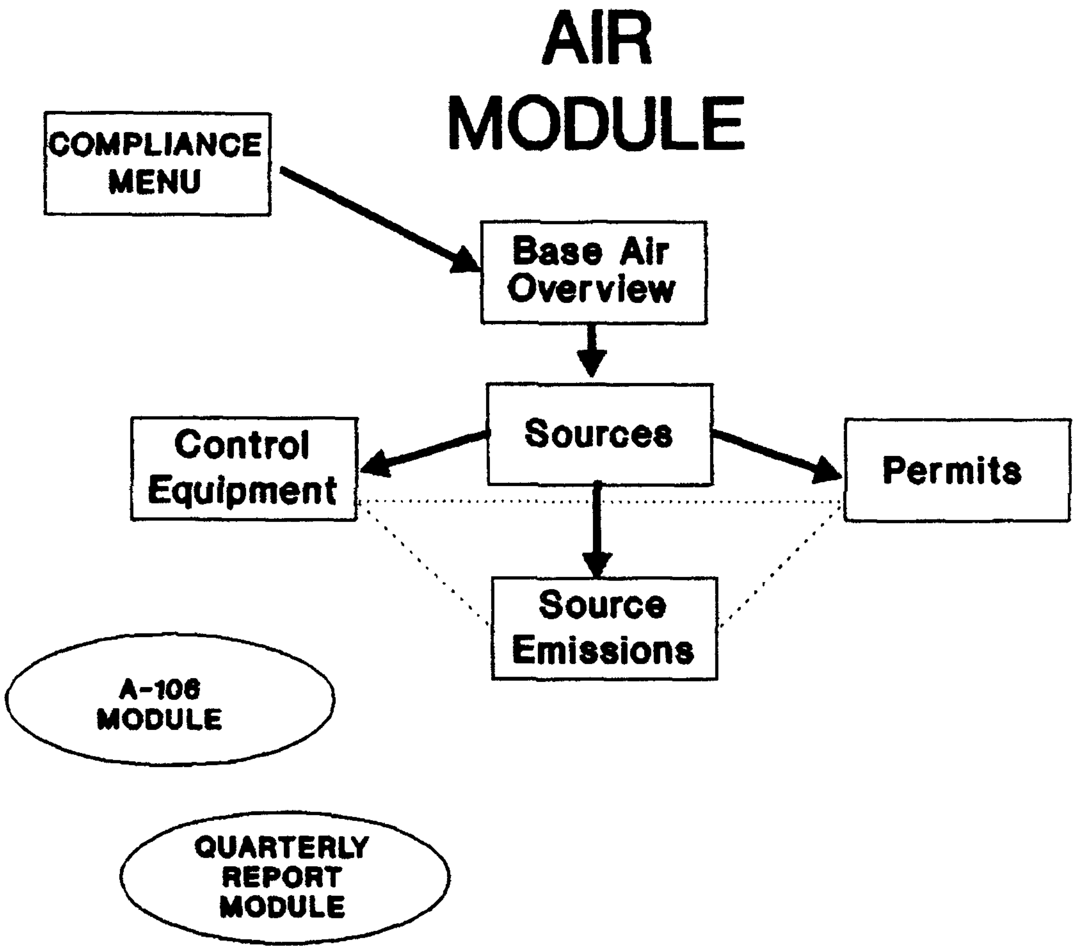
You should receive this package by 12 June 92. We ask that you return the questionnaire in the envelope provided by 28 June 92. This will allow us to address your comments and turn the program over to the AFMC development staff for coding and release.

Your assistance in making this module useful for the Air Force's environmental program is greatly appreciated. If you have any questions, feel free to contact us at AV 785-2156.

ROBERT A. CANTWELL, Capt, USAF
AFIT Graduate Student

JONATHAN S. DAVIS, Capt, USAF
AFIT Graduate Student

5 Atch
1. Data Flow Chart
2. Screens
3. General Info
4. Data Dictionary
5. Questionnaire


AIR
MODULE
COMPLIANCE
MENU
Base Air
Overview
Sources
Control
Equipment
Permits
Source
Emissions
A-106
MODULE
QUARTERLY
REPORT
MODULE

AIR QUALITY MANAGEMENT - OVERVIEW OF BASE AIR

Date of Last Update **** ** **

MAJCOM *** Base ******* State ** EPA Region **

Total Number of Notice of Violations (NOVs) ***
Total Number of Compliance Agreements (CAs) ***
Air Emergency Episode Plan * Date **** ** **

	Type of Attainment Area					
	PM	SO2	NOX	OZONE	CO	LEAD
Mild	*	*	*	*	*	*
Moderate	*	*	*	*	*	*
Serious	*	*	*	*	*	*
Severe	*	*	*	*	*	*
Extreme	*	*	*	*	*	*

Air Quality Control Region *
Total Number of Emission Sources ****
Total Number of Permits PSD *** State *** Local ***
Total Permit Costs $ ******
Total Number of Control Equipment Items ****

AIR QUALITY MANAGEMENT - SOURCE INFORMATION

Date of Last Update **** ** **

MAJCOM *** Base ******* State ** EPA Region **
Source ID Number ***** Source Category ***************
Facility ***** ** Source Type ***************

Source Description ***
****

Owner ************ POC *************** Phone -
****

Exhaust Ventilation Type ********** Other **********
Manufacturer *************** Make ***************
Serial Number *************** Model ***************
EPA Source Classification ************
Date Installed **** ** ** Associated Projects *
Operational Status * Control Equipment *
Type of Permit Required ************** NOV *

AIR QUALITY MANAGEMENT - CONTROL EQUIPMENT

Date of Last Update **** ** **

MAJCOM ***   Base *******   State **   EPA Region **
Source ID Number *****   Source Category ***************
Facility   ***** **   Source Type   ***************

Control Equipment Type ********************
Describe if Other *************************
Purpose of Equipment *********
Control Description **
****

Manufacturer ***************   Make ***************
Serial Number ***************   Model ***************
Operational Status ********   Initial Operation Date **** ** **
Pollutants Controlled: Particulates *   SO2 *   VOC *   CO *   NOX *
Other ****** ****** ****** ****** ****** ******

AIR QUALITY MANAGEMENT - EMISSIONS

Source ID # *****   Facility   ***** **   Date of Last Update **** ** **
Source Category ***************

Emission Type	Method	EMISSIONS LB/Hr(Max)	FY **** LB/Day	Tons/Yr	Specified Tons/Yr
****************	*	****	*****	****	****

Comments:**
****
****

AIR QUALITY MANAGEMENT - PERMIT INFORMATION

Date of Last Update **** ** **

MAJCOM *** Base ******* State ** EPA Region **

Source ID # ***** Facility ***** ** Source Category ***************

Source Type ***************

Permit Type: PSD * State * Local * Permit Status *

In Compliance with Permit *

Permit to Install # ************* Registration # **************

Permit to Operate # ************* Application # **************

Issuing Agency ************** POC ************** Phone *************

Fiscal Year	****	****	****
Application Fee	*****	*****	*****
Installation Fee	*****	*****	*****
Operating Fee	*****	*****	*****
Variance Fee	*****	*****	*****
Certification Fee	*****	*****	*****
Renewal Fee	*****	*****	*****
Total Fees	******	******	******

AIR QUALITY MANAGEMENT - PERMIT INFORMATION

Date of Last Update **** ** **

Source ID # ***** Facility ***** ** Source Category ***************

Source Type ***************

ASSOCIATED PERMIT MILESTONE DATES

Original Permit Application Date	**** ** **
Permit to Install Issue Date	**** ** **
Date Agency Notified That Installation was Complete	**** ** **
Original Permit to Operate Date	**** ** **
Latest Date Permit Amended	**** ** **
Latest Date Permit Reissued	**** ** **
Effective Date of Latest Reissue	**** ** **
Date for Permit Inspection/Testing	**** ** **
Date Permit Expires	**** ** **
Date Renewal Required	**** ** **
Date Renewal Submitted	**** ** **

GENERAL INFORMATION

The air module is designed to allow the base level air manager to store data concerning their specific air program. Once the data is stored, it can be easily viewed and modified as necessary. More importantly, the data can be consolidated into reports and passed through staff levels or given to regulators as useful information.

The air module consists of an overview screen and four separate programs as described below.

1) Overview Screen: This screen gives a broad overview of a base's air program and is the first screen seen when entering the air module.

2) Source Information Program: This program allows the air manager to store data concerning each emission source on the base. The program assigns a unique identifier to each source as it is loaded. This program forms the framework for the module as all other programs are linked to it, and is the basis for each base's emission inventory.

3) Permit Program: This program allows the air manager to store data concerning the base's air permits. The program is designed to store permits that govern multiple sources or a single source.

4) Control Equipment Program: This program allows the user to enter data concerning a source's control equipment. The program allows each source to have multiple pieces of control equipment.

5) Emissions Program: This program allows the user to enter each source's emissions. A separate screen is used for each pollutant. The user can choose from the criteria pollutants and any of the toxics listed in the CHRIS directory.

The current program does not calculate emissions itself. An AP-42 emission calculator program may be included in future versions of the air module.

Air Dictionary

THE DICTIONARY IS A SHORT EXPLANATION OF EACH DATA FIELD THAT WILL BE READILY ACCESSIBLE TO THE USER. THIS DOCUMENT IS USED FOR PROGRAMMING PURPOSES ONLY. IT IS NOT GIVEN TO THE USER. ONCE THESE DEFINITIONS ARE PUT "ON-LINE," THIS DOCUMENT WILL BE DELETED AND ONLY THE ON-LINE VERSION MAINTAINED.

OVERVIEW OF BASE AIR SCREEN

1. MAJCOM: The three character MAJCOM code. Automatically entered by the system.

2. Base: The 8 character base code (name). When the record is added at the base, this code is automatically entered by the system.

3. Date of last update: Self explanatory.

4. State: Automatically entered by the system. The state location of the base/site.

5. EPA Region: Automatically entered by the system. The region of authority at the base/site.

6. Total Number of Notice of Violations (NOVs): The total number of Notices of Violation (NOVs) received by the base from the appropriate regulatory agency for a violation of any air compliance requirement. This is automatically loaded from the Quarterly Tracking Module.

7. Total Number of Compliance Agreements (CAs): The total number of current Compliance Agreements (CA) with regards to air pollution. This is automatically loaded from the Quarterly Tracking Module.

8. Air Emergency Episode Plan: Does the base have a current Air Emergency Episode Plan? Y or N.

9. Date: Date of the current Air Emergency Episode Plan.

10. Type of Attainment Area: Mark fields "Y" which apply to the attainment status at your base.

11. Air Quality Control Region: "Y" or "N".

12. Total Number of Emission Sources: The total number of emission sources located at the base. This number is automatically entered by the system from the total number of records that have been added.

13. Total Number of Permits: The total number of different types of permits. This number is automatically calculated by the system from the information entered in the permit screens.

14. Total Permit Cost: The total cost of all permits in the current fiscal year. This number is calculated by the system from the information entered in the permit screens.

15. Total Number of Control Equipment Items: The total number of pieces of control equipment on each emission source. This number is calculated from the number of records added in the control equipment screens.

SOURCE INFORMATION SCREEN

16. MAJCOM: The three character MAJCOM code. Automatically entered by the system.

17. Base: The 8 character base code (name). When the record is added at the base, this code is automatically entered by the system.

18. Date of last update: Self explanatory.

19. State: Automatically entered by the system. The state location of the base/site.

20. EPA Region: Automatically entered by the system. The region of authority at the base/site.

21. Source ID #: A unique identifier for this record and is automatically entered by the system. The first three characters identify the base. The last four numbers are a sequentially assigned number.

22. Facility ID #: The identification number of the facility where the emission source is located.

23. Source Category: Selectable field. Choose from the following categories of sources:

Internal combustion	Degreaser/solvent
External combustion	Jet engine test cell
Surface coating	Incinerators
Storage tanks	Abrasive cleaning
General process	Fuel load racks
Fuel dispense	Incident

24. Source Type: Selectable field. Choose from the following types of sources:

    Vented source
    Fugitive dust source
    Event log

25. Source Description: Brief description of the emission source.

26. Owner: Organization that is responsible for the facility where the emission source is located.

27. POC: Point of contact for the organization that is responsible for the facility.

28. Phone: Phone number of individual designated as point of contact for organization that is responsible for the facility. Space provided is enough for area code, prefix number, and suffix number. Fields one and five are open and close parentheses, respectively. Field nine is a dash.

29. Exhaust Ventilation Type: Selectable field. Choose from the following:

Stack	Window Fan
Roof Vent	Into Room
Open air	Other

30. Other: Describe other exhaust ventilation type if "other" is chosen in above field.

31. Manufacturer: Name of the manufacturer of the piece of equipment being entered.

32. Make: Manufacturer's make number or name. Usually provided on manufacturer's identification plate.

33. Serial #: Manufacturer's serial number. Usually provided on manufacturer's identification plate.

34. Model #: Manufacturer's model number or name. Usually provided on manufacturer's identification plate.

35. EPA source classification: Classification provided from EPA.

36. Date installed: Installation date of the piece of equipment being entered.

37. Associated Projects: Y or N. Describe in A-106 module.

38. Operational status: Is the piece of equipment being entered operational? Y or N.

39. Control equipment: Does the piece of equipment being entered have any control equipment associated with it? Y or N.

40. Type of permit required: Selectable field. Choose from the following types of permits:

Regulated/permit required
Regulated/no permit
Grandfathered
Unregulated
Undetermined

41. NOV: Is there an NOV associated with this source? Y or N.

CONTROL EQUIPMENT SCREEN

42. Date of Last Update: New date entered by the system when data is loaded or modified.

43. MAJCOM: The three character MAJCOM code. Automatically loaded by the system.

44. Base: The eight character base code. Automatically entered by the system.

45. State: Automatically entered by the system.

46. EPA Region: The EPA region governing the base. Automatically entered by the system.

47. Control Equipment ID Number: A unique identifier for this record and is automatically entered by the system. It is made up of the Source ID number (for the source being controlled by this piece of control equipment) followed by a single digit identifier.

48. Source Category: Automatically entered by the system from source information.

49. Facility: Automatically entered by the system from source information.

50. Source Type: Automatically entered by the system from source information.

51. Control Equipment Type: Selectable field. Choose from the following types of control equipment.

Settling Chamber	Cyclone
Electrostatic Precipitator	Multiple Cyclone
Baghouse	Spray Chamber
Cyclonic Scrubber	Impingement Scrubber
Orifice Scrubber	Venturi Scrubber
Plate or Tray Tower	Packed Tower
Adsorber	Condensor
Afterburner-Catalyst	Afterburner-Thermal
Other	

52. Describe if Other: Describe control equipment if not on list from previous field.

53. Purpose of Equipment: Selectable field. Primary or secondary.

54. Manufacturer: Manufacturer name for control equipment being entered.

55. Make: Manufacturer's make number or name for the control equipment being entered.

56. Serial Number: Manufacturer's serial number for the cortrol equipment being entered.

57. Model: Manufacturer's model number or name for the control equipment being entered.

58. Operational Status: Selectable field. Existing or proposed equipment.

59. Initial Operation Date: Self-Explanatory.

60. Pollutants Controlled: Place a Y or N for each pollutant controlled by this equipment. Fill in "other" field if pollutant controlled is not a criteria pollutant.

SOURCE EMISSIONS SCREEN

61. Source ID Number: Automatically entered by the system from the source information screen.

62. Facility: Automatically entered by the system from the source information screen.

63. Date of Last Update: New date is entered by the system when data is loaded or modified.

64. Source Category: Automatically entered by the system from the source information screen.

65. Fiscal Year: Enter the current fiscal year.

66. Emission Type: Selectable field. Choose from the following pollutants for which emissions are being tracked.

Particulates	Particulates <10
SOX	NOX
CO	VOC
Lead	

CHRIS (This program takes the user to the CHRIS program where a specific toxic can be chosen.)

67. Method: Selectable field. Choose from the following methods of emission calculations.

AP-42 (by air mgr)	AP-42 (by regulator)
Source Test	Estimate

Other (Describe in comments block)

68. LB/HR(Max): Enter the maximum emission level for the pollutant selected in pounds per hour for the current fiscal year.

69. LB/Day: Enter the actual emission level for the pollutant selected in pounds per operating day for the current fiscal year.

70. Tons/Yr: Enter the actual total emission level for the pollutant selected for the current fiscal year in tons per year.

71. Specified Tons/Yr: Enter the total emission level allowed by the regulator for the pollutant selected in tons per year for the current fiscal year.

PERMIT INFORMATION SCREEN

72. MAJCOM: The three character MAJCOM code. Automatically entered by the system.

73. Base: The 8 character base code (name). When the record is added at the base, this code is automatically entered by the system.

74. Date of last update: Self explanatory.

75. State: Automatically entered by the system. The state location of the base/site.

76. EPA Region: Automatically entered by the system. The region of authority at the base/site.

77. Source ID #: Must be entered by the user. This number is assigned in the Source Information Screen. If the permit covers multiple sources, enter "MULTI" in this field.

78. Facility ID #: Must be entered by the user. If the permit covers sources in more than one facility, enter "MULTI" in this field.

79. Source Category: Selectable field. Choose "MULTI" if this permit covers sources in multiple source categories. Choose from the following categories of sources:

- Internal combustion
- External combustion
- Surface coating
- Storage tanks
- General process
- Fuel dispense
- MULTI
- Degreaser/solvent
- Jet engine test cell
- Incinerators
- Abrasive cleaning
- Fuel load racks
- Incident

80. Source Type: Selectable field. Choose "MULTI" if this permit covers sources of multiple source types. Choose from the following types of sources:

- Vented source
- Fugitive dust source
- Event log
- MULTI

81. Permit Type: Mark appropriate permit type with a Y. PSD - Prevention of Significant Deterioration.

82. Permit status: Selectable field. Choose from the following permit status fields:

None applied for
Application submitted for permit to
construct/install/modify
Application submitted for permit to operate
Approved permit to operate
On registration
Application submitted for permit renewal
Permit inactive
Permit expired
Permit canceled

83. In compliance with permit: Is the piece source being entered in compliance with the permit? Y or N.

84. Permit to install number: If applicable, number is provided by the appropriate issuing agency.

85. Registration number: If applicable, number is provided by the appropriate issuing agency.

86. Permit to operate number: If applicable, number is provided by the appropriate issuing agency.

87. Application number: If applicable, number is provided by the appropriate issuing agency.

88. Issuing agency: Regulatory agent responsible for issuing the permit.

89. POC: Point of contact from regulatory agency responsible for issuing the permit.

90. Phone: Phone number of the point of contact from the regulatory agency responsible for issuing the permit. Space provided is enough for area code, prefix number, and suffix number. Fields one and five are open and close parentheses, respectively. Field nine is a dash.

91-93. Enter appropriate fiscal years.

94. Application fee: Permit application fee. Enter in whole dollars.

95. Installation fee: Permit installation fee. Enter in whole dollars.

96. Operating fee: Permit operating fee. Enter in whole dollars.

97. Variance fee: Permit variance fee. Enter in whole dollars.

98. Certification fee: Permit certification fee. Enter in whole dollars.

99. Renewal fee: Permit renewal fee. Enter in whole dollars.

100. Total fees: Total permit fees. System will automatically total fees.

PERMIT INFORMATION SCREEN 2

101. Date of Last Update: New date is entered by the system when data is loaded or modified.

102. Source ID Number: Automatically entered by the system.

103. Facility: Automatically entered by the system.

104. Source Category: Automatically entered by the system.

105. Source Type: Automatically entered by the system.

106-116. Enter the applicable dates for this permit.

AIR MODULE QUESTIONNAIRE

In each comment block, please identify any fields or features that you think are useful. Also, identify any fields or features you would like to see added or omitted. All suggestions will be evaluated.

OVERVIEW SCREEN

Comments:____

SOURCE SCREEN

Comments:____

Do you have any sources that are not listed in the selectable <u>Source Category</u> fields (See #23, Data Dictionary)?

Yes (describe)____No___

CONTROL EQUIPMENT SCREEN

Comments:____

Do you have any pieces of control equipment that are not listed in one of the selectable <u>Control Equipment Type</u> fields (See #51, Data Dictionary)?

Yes (describe)____No___

SOURCE EMISSIONS SCREEN

Comments:____

____

____

____

PERMIT SCREENS

Comments:____

____

____

____

Do you have any sources with more than one air operating permit?

Yes_____No_____

Appendix B: Final Air Module Data Dictionary

Air Module Dictionary

THE DICTIONARY IS A SHORT EXPLANATION OF EACH DATA FIELD THAT WILL BE READILY ACCESSIBLE TO THE USER. THIS DOCUMENT IS USED FOR PROGRAMMING PURPOSES ONLY. IT IS NOT GIVEN TO THE USER. ONCE THESE DEFINITIONS ARE PUT "ON-LINE," THIS DOCUMENT WILL BE DELETED AND ONLY THE ON-LINE VERSION MAINTAINED.

OVERVIEW OF BASE AIR SCREEN

1. MAJCOM: Automatically entered by the system. The owning MAJCOM.

2. Base: Automatically entered by the system. The base that the record is being created for.

3. Date of last update: Self explanatory.

4. State: Automatically entered by the system. The state location of the base/site.

5. County: Automatically entered by the system. The county location of the base/site.

6. EPA Region: Automatically entered by the system. The region of authority at the base/site.

7. Air Emergency Episode Plan?: Does the base have a current Air Emergency Episode Plan? Y or N.

8. Date: If yes, enter the date the Plan was signed. YYYY MM DD

9. Transportation Management Plan?: Does the base have a current Transportation Management Plan? Y or N.

10. Date: If yes, enter the date the Plan was signed. YYYY MM DD

11. Completed Air Emission Inventory?: Has the base completed the emission inventory for the base? Y or N

12. Date: If yes, enter the date the inventory was completed. YYYY MM DD

13. Certified?: Has the inventory been certified by a base official? Y or N

14. Date: If yes, enter the date the inventory was certified. YYYY MM DD

15. Air Quality Control Region (AQCR): What is the number as designated by the EPA?

16. Enforcement Actions: Are there any enforcement actions (NOVs, NONs, NODs, Compliance Agreements, etc.) for the air program for the base? Y or N

17. Type of Federal Nonattainment Area: For each column and pollutant, enter Y or N according to the categories Marginal, Moderate, Serious, Severe 15, Severe 17, Extreme.

17a. In Attainment?: Is the AQCR where the base is located in attainment with the criteria pollutants? Y or N

18. Base Air Program Mgr: Enter the name of the base program manager.

19. DSN: Enter the DSN for the program manager.

SOURCE INFORMATION SCREEN

20. MAJCOM, Base, Date of last update, County, State, and EPA Region repeated.

21. Source ID #: A unique identifier for this record and can be assigned by the base.

22. Source Category: Selectable field using PF 14. Choose from the following categories of sources:

Internal combustion	Int Combst
External combustion	Ext Combst
Surface coating	Coating
General process(also for "other")	GenProcess
Fuel dispense	Fuel Disp
Degreaser/solvent	Degrs/Solv
Jet engine test cell	Test Cell
Incinerators	Incinerators
Abrasive cleaning	Abrs Clean
Fuel load racks	Fuel Ld Rac
Event (ie fire training area)	Event
Oil/water Separator	Oil/Water
Air Stripper	Air Strip
Mobile Source	Mobile
Underground Storage Tank(s)	UST
Above Ground Storage Tank(s)	AbvGndTnk

23. Facility #: The identification number of the facility where the emission source is located. If there is no facility number available, enter zeroes.

24. Source Title: Enter a title for this source that will identify it easily.

25. Permit Requirement: Selectable field using PF 14. Choose from the following types of permits:

Regulated/permit required	Permit Req
Regulated/no permit	No Permit
Grandfathered	Grndfather
Unregulated	Unreg
Undetermined	Undeter

26. Operational Date: Enter the date this source was installed or became operational. If not available, use best guess.

27. In Use?: Is the equipment currently in use? Y or N

28. Install/Construct Record #: If there is an install or construction permit for this source, enter the record number assigned to it by this system.

29. Operate Record #: If there is a permit to operate for this source, enter the record number assigned to it by this system.

30. Manufacturer: Name of the manufacturer of the piece of equipment being entered.

31. Make: Manufacturer's make number or name. Usually provided on manufacturer's identification plate.

32. Serial #: Manufacturer's serial number. Usually provided on manufacturer's identification plate.

33. Model #: Manufacturer's model number or name. Usually provided on manufacturer's identification plate.

34. Exhaust Ventilation: Selectable field using PF 14. Choose from the following:

Stack
Roof Vent
Open air
Window Fan
Into Room
Other

35. If other, describe: If other is chosen for exhaust ventilation, enter a descriptive term describing.

36. Control equipment?: Does this emission source have any control equipment associated with it? Y or N.

37. Source Description: A brief, concise description of the emission source.

38. Owner: Organization (office symbol/unit) that is responsible for the emission source.

39. POC: Point of contact for the organization that is responsible for the emission source.

40. Phone: Phone number of individual designated as point of contact for organization that is responsible for the emission source.

41. Comments: Any comments pertaining to the emission source.

CONTROL EQUIPMENT SCREEN

42. MAJCOM, Base, Date of last update, County, State, and EPA Region repeated.

43. Equipment ID #: A unique identifier for this record and is automatically entered by the system. It is made up of the Source ID number (for the source being controlled by this piece of control equipment), a "C" (to identify the number as control equipment), and followed by a single digit identifier.

44. Facility #: Automatically entered by the system from parent source information record.

45. Control Equipment Type: Selectable field. Choose from the following types of control equipment.

Dry or Fabric Filters	Dry Filters
Settling Chamber	SettlingChamber
Electrostatic Precipitator	Elec Precip
Baghouse	Baghouse
Cyclonic Scrubber	Cyclonic Scrub
Orifice Scrubber	Orifice Scrub
Plate or Tray Tower	Plt/tray Tower
Adsorber	Adsorber
Afterburner-Catalyst	Afterburn Cat
Cyclone	Cyclone
Multiple Cyclone	Multi Cyclone
Spray Chamber	Spray Chamber
Impingement Scrubber	Impingement
Venturi Scrubber	Venturi Scrub
Packed Tower	Packed Tower
Condensor	Condensor
Afterburner-Thermal	Afterbrn Thml
Water Injection System (Test Cell)	Water Inject
Other	Other

46. If other, describe: Describe control equipment if not on list from previous field.

47. Purpose of Equipment: Selectable field. P (Primary) or S (Secondary).

48. Equipment Status: Selectable field using PF 14. Choose the appropriate status.

Operational	Oper
Nonoperational	Nonop
Proposed	Prop

49. Initial Operation Date: Enter the date operation began. YYYY MM DD

50. Pollutants Controlled: Place a Y or N for each pollutant controlled by this equipment.

51. Other: Enter any other pollutants that are controlled by this equipment. Maximum allowed is two. Suggest using the CHRIS manual to obtain codes.

52. Efficiency %: Enter the percent of efficiency for this piece of equipment.

53. Preventative Maintenance #: If applicable, enter the preventative maintenance number.

54. Manufacturer: Manufacturer name for control equipment being entered.

55. Make: Manufacturer's make number or name for the control equipment being entered.

56. Serial Number: Manufacturer's serial number for the control equipment being entered.

57. Model: Manufacturer's model number or name for the control equipment being entered.

58. Comments: Enter any comments pertaining to this piece of control equipment.

SOURCE EMISSIONS SCREEN

59. MAJCOM, Base, Date of last update, County, State, and EPA Region repeated.

60. Emission ID #: Automatically entered by the system from the source information screen. A unique identifier for this record. It is made up of the Source ID number (for the source being controlled by this piece of control equipment), a "E" (to identify the number as an emission), and followed by a two digit identifier assigned by the system.

61. Source Category: Automatically entered by the system from the parent source information screen.

62. Facility #: Automatically entered by the system from the source information screen. The facility number where the emission source is located.

63. Emission Type: Selectable field using PF 14. Choose from the following pollutants for which emissions are being tracked.

Particulates	Particulate
Particulates <10 microns	Par LT 10
SOX (Sulfur Compounds)	Sulfur Ox
NOX (Nitrous Oxide Compounds)	Nitrous Ox
CO (Carbon Monoxide)	Carbon Mon
VOC (Volatile Organic Compounds)	VOCs
Lead	Lead
Other Hazardous Pollutants	Other

64. CAS #: If Other, enter CAS #. Do not use hyphens.

65. Pollutant: If CAS # cannot be entered, enter the common name for the pollutant.

66. Method: Selectable field using PF 14. Choose from the following methods of emission calculations.

Mass Balance	Mass Bal
AP-42	AP-42
Source Test Results	Srce Test
Estimate	Estimate
Other (Describe in comments)	Other

67. Are there emission controls for this pollutant?: Y or N

68. If yes, indicate efficiency: Percent efficiency of control equipment.

69. CY: To establish the matrix, enter four calendar years to list the monthly and actual amounts emitted.

70. Permitted: Enter the amount (by the units identified) that is permitted to be released for the CY.

71. Actual: Enter the amount (by the units identified) that is actually released for the CY.

72. Units: Enter the units being tracked.

Pounds per week	Lbs/wk
Pounds per year	Lbs/yr
Tons per week	Ton/wk
Tons per year	Ton/yr

73. Comments: Enter any comments pertaining to this emission.

PERMIT INFORMATION SCREEN ONE

74. MAJCOM, Base, Date of last update, County, State, and EPA Region repeated.

75. Record #: A unique sequentially assigned number to identify this permit. This is assigned by the system.

76. Permit Title: Enter a title for this permit that will identify it easily.

77. Permit #: Enter the number on the permit/registration.

78. Application #: If appropriate, enter the application number.

79. Issuing Authority: Selectable field using PF 14. Choose the appropriate permit issuing authority.

EPA/Federal	USEPA
State	State
District	Dist
County	County
City	City
Host Nation	Host
Other	Other

80. Type Permit: Selectable field using PF 14. Choose the appropriate type of permit.

Permit to Install/Construct	Install
Permit to Operate	Operate
Registration	Regis
Other (clarify in comments)	Other

81. Permit Status: Selectable field using PF 14. Choose the appropriate status of permit.

Submitted Application	Submit
Submitted Renewal	Renewal
Draft Received From Regulator	Draft
Approved	Approved
Inactive	Inactive
Expired	Expired
Permit not needed, Reg notified	Cancelled
Other (clarify in comments)	Other

82. PSD(Prevention of Significant Deterioration)?: Is a federal review required for a significant deterioration? Y or N.

83. Regulator's POC: Enter the name and/or office of the POC at the regulatory agency for this permit.

84. Phone: Phone number of the point of contact from the regulatory agency responsible for issuing the permit.

85. CY: Enter the CY for the fees to be tracked in each column.

86. Fees: Enter any fees according to the categories listed. Enter in whole dollars. If other is used, describe in comments.

87. Comments: Enter any comments pertaining to this permit.

PERMIT INFORMATION SCREEN TWO

88. MAJCOM, Base, Record #, Permit #, and Type Permit are carried from first permit screen.

89. Dates: Enter the appropriate actual dates. Renewal Required and Renewal Submitted can be future date.

90. Other: If other milestones need to be tracked, use the blank to identify it and then enter the associated date.

91. Comments: Enter any appropriate comments pertaining to the milestones.

Appendix C: Future Emission Data Input Screens

```
Source ID Number *****     Facility  ***** **

              SOURCE TYPE: INTERNAL COMBUSTION/OPERATING DATA
Type of Stationary Source      *************************
Type of Non-Stationary Source  *************************
                        Other  *************************

Operating Schedule:    Hr/Day ****   Day/Wk *    Wk/Yr **
Gas Turbine: Rated Output(MW)******* Fuel Type******** Other ********
Gas/Diesel: Displac (cid)  ******* Fuel Type ******** Other ********
              Rated Power (hp)  ****

Fuel Usage:                  Oil              Gasoline         Diesel
Hourly Max (gal)            *****              *****            *****
Annual Max (gal)           *******            *******         *******
Annual Avg (gal)           *******            *******         *******
Natural Gas     Hourly Max (scf) ********   Annual Avg (scf) ********
                                            Annual Max (scf) ********

Seasonal Avg Fuel Usage (%):Spring *** Summer *** Fall *** Winter ***
```

```
Source ID Number   *****     Facility  ***** **

          SOURCE TYPE: EXTERNAL COMBUSTION/OPERATING DATA
Firing Type(Coal Fired Units) **************
                        Other **************
Atomization Type(Oil Fired Units) *************
                         Other *************
Combustion Monitoring Type   Fuel/Air Ratio: *  Oxygen: *  Smoke: *
                         Other ********************
Draft Type *******       Fly Ash Reinjection *     Oil Preheater *
                         Oil Preheater Temp *** (F)
Input Capacity(Btu/hr)    Rated ******** Normal ******** Max ********
Output Capacity(Lb stm/hr)Rated ******** Normal ******** Max ********

Operating Schedule:    Hr/Day ****   Day/Wk *    Wk/Yr **

Uses(% of Total Annual Output):
Electric Generation *** % Industrial Process *** % Hot Water *** %
Space Heating       *** % Other              *** %
```

Source ID Number ***** Facility ***** **

SOURCE TYPE: FUEL DISPENSING/OPERATING DATA

Disp Tank #*************** Fuel Stored******** Capacity (gal) *******
Pressure Vacuum Vent * Manuf *************** Model ***************
Max Vertical Distance From End of Fill Pipe to Tank Bottom (in) ***

Type of Stage I Vapor Control System ******************
Other ****************************
Number of Dispensing Nozzles **

	Manuf 1	Model 1	#	Manuf 2	Model 2	#
Nozzles	**************	************	**	**************	************	**
Swivel	**************	************	**	**************	************	**
Retract	**************	************	**	**************	************	**

Type of Stage II Vapor Control System *****************
Vapor Piping Slope Toward Tank *
Vapor Manifolded and Returned to One Tank *
Vapor Pipe Diameter(in) ** Main Vapor Line Pipe Material **********

Source ID Number ***** Facility ***** **

SOURCE TYPE: LOADING RACK/OPERATING DATA

Loading Method *************************
Vehicle Type *************** Other *************

Vapor Control System **************** Other *************
Vapor Balance Ctrl Effic: *** %
Other Control System Control Efficiency *** %
Other Control System Emission Rate (Lb/1000 Gal): ****
Vapor Control System Manufacturer ***************
Model ***************
Describe **

Date Installed **** ** ** Date Initially Operated **** ** **

Number of Loading Arms ** Pump (hp) ***

Operating Schedule: Hr/Day **** Day/Wk * Wk/Yr **

Source ID Number ***** Facility ***** **

SOURCE TYPE: SURFACE COATING/PRINTING DATA

Surface Coating Type **********************
Operation Type (If not Spray Booth) **********************************
Coating/Printing Method **
Describe Articles Coated ***
Type of Spraying ****************** Transfer Efficiency (%) ***
Spraying Operation ********* Heat Dry/Bake (>194 F) *
Spray Booth Type ********* Operating Temperature (F) *****
Spray Booth Dimensions (ft): Height ** Length ** Width **
Spray Booth Exhaust Type ************* Other ***********
Filter Material ********** Changes/Year ***
Filter Size (in): Thick *** Length *** Width ***
Exhaust Fans: Manufacturer ************* Model *************
Size (hp) *** Number **
Water Wash Data: Paint Spray Booth Recir Water * Pump Size(hp) ***
Chemical Added to Water * Material Reclaimed *

Operating Schedule: Hr/Day **** Day/Wk * Wk/Yr **

Source ID Number ***** Facility ***** **

SOURCE TYPE: GENERAL PROCESS/OPERATING DATA

Type of Process ***
Type of Equipment ***
Exhaust Vent Type ********** Multiple Exhausts *
Capacity **************** Rated ****** Maximum ******
Booth/Enclosure/Tank Size (ft): Length ***** Height/Width *****
Depth ***** Tank Capacity *****
Process End Product: **
Production Rate****** Hourly Avg***** Daily Avg***** Annual Avg *****
Hourly Max***** Daily Max***** Annual Max *****
Operation Type ********** Projected Annual Increase (%) ***
Batch Cycle Time (min) **** Time Between Cycles ****

Normal Operating Schedule: Daily **** (hr/day) Weekly **** (day/wk) Annual **** (wk/yr)
Occasional Operation: Avg Time Per Use (hr) ***** Annual Uses *****

Seasonal Avg Operation: Spring *** Summer *** Fall *** Winter ***

Source ID Number ***** Facility ***** **

SOURCE TYPE: ABRASIVE CLEANING/SANDBLASTING OPERATING DATA

Booth: Manufacturer *************** Model # ***************
Serial # ***************
Water Spray: Manufacturer *************** Model # ***************
Enclosure Installation Date **** ** **
Description ***
Location * Sandblast Method ********** Other ****************
Enclosure Size (ft): Height ** Length ** Width **
Fugitive Emission Control *
Description ***
Spray Attach Control Efficiency ** % Overall Control Efficiency ** %
Enclosure Capture Efficiency ** % (Internal Control)

Describe Products ************************ Max Hrly *** Annual ******

Operating Schedule: Hr/Day **** Day/Wk * Wk/Yr **

Comments: **

Source ID Number ***** Facility ***** **

SOURCE TYPE: JET ENGINE TESTING OPERATING DATA

Engine Model # **************** Aircraft Model # ************
Testing mode *********************** Exhaust Control ***************
Testing Facility ****************** Other *******************
Number of Engines per Aircraft *
Type of Fuel Used **** Annual Quantity of Fuel Used (gal) ********

Average Duration per Test:

Engine Setting	Time(min)
Idle	****
Approach	****
Intermediate	****
Military	****
Afterburner	****

Number of Engines Operating per Test *
Annual Number of Tests: Average **** Max ****

Seasonal Testing: Spring *** % Summer *** % Fall *** % Winter *** %

Source ID Number ***** Facility ***** **

SOURCE TYPE: STORAGE TANKS OPERATING DATA

Tank Type ***************** Other ****************** Cap (gal) *******
Tank Shape ***************** Other ******************
Tank Size: Diameter *** Height *** Length *** Width ***
Cylinder Height (Cone Roof) *** Cone Height **
Shell Material ***** Fill Type ******** Tank Condition ****
Other ******** Other ************
Shell Paint *********** Roof Paint *********** Condition ****
Vent Valve Type ******* # Vents ** PSI *** Vent Discharge ***********
Date Initially Filled(NSPS) **** ** ** Max Fill Rate(gal/hr) *****
Mat Stored ************ NSN ************** Mil Spec # ***************
Initial Boiling Pt(F)*** Flash Pt *** Temp (F): Min ** Avg ** Max ***
Hazardous * EPA Hazardous Waste Number ****************
Stored or Liquid Gas: Pressure **** Temp (F) ***

Throughput: Daily Avg ***** Annual Avg ******* Annual Turnover ***
(gal/day) (gal/yr)
Percentage of Annual:Spring ***% Summer ***% Fall ***% Winter ***%

Source ID Number ***** Facility ***** **

SOURCE TYPE: INCINERATORS/OPERATING DATA

Type of Incinerator ***************** Other ************************
Number of Chambers in Series (Multiple Chamber) **
Method of Charging ***************** Other ************************
Type of Charging ************ Type of Draft *******
Type of Flue Damper ********** Adjustable Air Ports *
Secondary(/afterburner)Ignition Type ******************************
Secondary(/afterburner)Temp Ctl * Type Refractory *****************
Secondary(/afterburner)Temp Lower Limit Control **** (F)
Rated Input Capacity (lb/hr): Trash ***** Rubbish *****
Rubbish and Garbage ***** Garbage ***** Human/Animal Remains *****
Industrial Waste (solid) ***** Industrial Waste (not solid) *****
Auxiliary Burner Size (Btu/hr): Primary ******* Secondary *******
Primary Chamber Size (in): Height **** Length **** Width ****
Area (Max Horizontal Inside Cross-Sectional Area - sq ft) ****
Secondary Chamber Size (in): Height **** Length **** Width ****

Fuel Type **********

Source ID Number ***** Facility ***** **

SOURCE TYPE: INCINERATORS/OPERATING DATA-CONTINUED

Waste Description: Paper * Cardboard * Wood * Rags * Sweepings *
Kitchen Waste * Residential Waste * Human/Animal Remains *
Plastics **************** Industrial *****************************
Waste Type: Trash * Rubbish * Garbage(Animal and Vegetable Waste) *
Human/Animal Remains * Rubbish and Garbage(50/50) *
Industrial Waste (solid) * Industrial Waste (not solid) *
Combustible Waste Source and Size: Hospital(beds) ****
Restaurant(meals/day) **** Commercial Building (sf) ******
School(rooms) *** School(students) **** Apartment(units) ****
Industrial Process: ***************************************
Other: ***
Waste Qty Incinerated:Hourly Avg(lb/Hr) ***** Hourly Max(lb/Hr) *****
Annual Avg (lb/Yr) ******* Annual Max(lb/Yr) *******

Seasonal Average: Spring *** % Summer *** % Fall *** % Winter *** %
Projected Annual Increase in Incineration *** %
Operating Schedule:Daily(hr/day) ** Weekly(day/wk) * Annual(wk/yr) **

Source ID Number ***** Facility ***** **

SOURCE TYPE: DEGREASERS/OPERATING DATA

Degreaser Type *********************** Other ***********************
Integral Emission Ctl Device: Freeboard Ratio >= 0.75 * Water Cover *
Enclosed Solvent Sump * Carbon Adsorption * Refrigerated Chiller *
Enclosed Design * Refrig Cond Coil * Other *********************
Safety Switches (Vapor Degreasers only):
Condenser Flow to Thermostat * Spray/Low Vapor Level Switch *
Spray/High Vapor Level Switch * Other ****************************
Cold Cleaners and Solvent Spray Booths:
Type of Solvent Handling *************** Cover Included *
Cover Operable by One Hand * Describe Cover Oper *****************
Drainage Facility Included * Describe ****************************
Open Top Vapor Degreasers:
Heating Method ******** Fixed Spray Nozzle * Cover * Powered *
Describe Cover Operation **
Coveyorized Degreasers:
Heating Method ******** Fixed Spray Nozzle * Cover *
Describe Cover Operation **
Parts Drain/Dry:Dry Tunnel* Rotating Basket* Other****************

Source ID Number ***** Facility ***** **

SOURCE TYPE: DEGREASERS/OPERATING DATA-CONTINUED

Tank/Spray Booth Inside Dimensions (ft):
Height *** Length *** Width *** Diameter ***
Cold Cleaner Tank or Spray Booth Capacity (gal) *****
Freeboard Dimensions (Cold Clean/Open Top) (in):
Height *** Length *** Width *** Ratio ***
Air Vapor Interface Area (sq ft) *** Solvent Temp (F) ***
Heat Rate: Gas/Steam Vapor(Btu/hr) ****** Electric Vapor(kW) ******
Operating Temp of Refrigeration Control Devices (F) ***
Exhaust Fan(Solvent Spray Booth): # of Fans ** Horsepower (ea) ***
Vent Rate w/Cover Open-Carbon Adsorption (acfm) *****
Controlled Emission Rate-Carbon Adsorption (ppm) *****
Product Cleaned *******************
Cleaning Rate(units/hr): Average ***** Maximum *****
Operating Schedule:Daily(hr/day) ** Weekly(day/wk) * Annual(wk/yr) **
Season Average: Spring *** % Summer *** % Fall *** % Winter *** %
Solvent Name ****************** NSN ****************
Density (lb/gal) *** Cold Cleaners-Vapor Pressure @ 100F(psia) *****

Appendix D: Air Staff Module Validation Meeting Message

UNCLASSIFIED

01 03 222300Z JUN 92 RR RR UUUU 174230O

HQ USAF BOLLING AFB DC//CEV//

HQ AFMC WRIGHT PATTERSON AFB OH//CEV/CEVV//

HQ ACC LANGLEY AFB VA//CEV//

HQ AMC SCOTT AFB IL//CEV/CEST//

HQ ATC RANDOLPH AFB TX//DEV//

HQ AFSPACECOM PETERSON AFB CO//CEV//

HQ PACAF HICKAM AFB HI//DEV//

HQ AFRES ROBINS AFB GA//CEP//

HQ USAFA COLORADO SPRINGS CO//DEP//

CETSO NEWPORT NEWS VA//ESOU//

INFO HQ USAF WASHINGTON DC//CEVC//

AFCEE BROOKS AFB TX//ES//

HQ USAF RGN ENV OFFICE ATLANTA GA//ESA//

HQ USAF RGN ENV OFFICE DALLAS TX//ESD//

AFCEE SAN FRANCISCO CA//ESS//

2750 ABW WRIGHT PATTERSON AFB OH//EM//

UNCLAS

SUBJ: WORKSHOPS FOR WIMS-ES COMPLIANCE MODULES

1. YOU ARE INVITED TO SEND A REPRESENTATIVE OR REPRESENTATIVES TO SUBJECT WORKSHOP FOR WIMS-ES AIR, WATER, PCB, AND WASTE MANAGEMENT

TIMOTHY R. MIDDLETON, MAJ, USAF
HQ USAF/CEVC, DSN 297-6240

UNCLASSIFIED 222300Z JUN 92

UNCLASSIFIED

02 03 222300Z JUN 92 RR RR UUUU 1742300

MODULES. PURPOSE OF WORKSHOP IS TO DEFINE REQUIREMENTS AND PROVIDE FOR BETTER SOFTWARE DESIGN AND LESS SOFTWARE MAINTENANCE. WORKSHOPS WILL CONVENE AT AFIT, BLDG 125, RM 2456, WPAFB, AND WILL BE FACILITATED BY WIMS-ES DEVELOPMENT TEAM. TENATIVE SCHEDULE IS AS FOLLOWS:

PCB MODULE DISCUSSION, 29 JUN, 1300-1700.

WATER MODULE REQUIREMENTS, 30 JUN-1 JUL, 0800-1700 BOTH DAYS.

AIR MODULE DISCUSSION, 2 JUL, 0730-1200.

WASTE MODULE REQUIREMENTS, 8-10 JUL, 0800-1700 EACH DAY (WASTE MODULE WILL COMBINE HAZARDOUS AND SOLID WASTE MGMT REQUIREMENTS). YOUR REPRESENTATIVE(S) SHOULD HAVE PROGRAM MANAGEMENT EXPERIENCE IN THESE MEDIA AREAS. ATTENDEES SUPPORTING DEVELOPMENT OF A SPECIFIC MODULE SHOULD PLAN ON BEING PRESENT FOR THE ENTIRE TIME SCHEDULED FOR THAT MODULE.

2. MODULES ARE INTENDED TO PROVIDE INSTALLATION AND MAJCOM PROGRAM MANAGERS WITH AUTOMATED TOOLS TO MORE EFFECTIVELY MANAGE THESE PROGRAMS. MOST OF WORKSHOP WILL CONCENTRATE ON DEVELOPING WATER AND WASTE MODULES, SINCE REQUIREMENTS ARE NOT YET WELL DEFINED. SINCE AIR AND PCB MODULES ARE FARTHER ALONG, WE ARE PLANNING TWO HALF-DAY SESSIONS TO CAPTURE YOUR COMMENTS ON THE EXISTING AIR AND PCB MODULE

DESIGNS.

3. INDIVIDUAL WORKSHOPS ARE LIMITED TO 12 PERSONS. PLEASE DESIGNATE YOUR REPRESENTATIVES(S) FOR THE PCB, WATER, AND AIR WORKSHOPS BY 26 JUN 92 BY CONTACTING MAJ TIM MIDDLETON, AF/CEVC, DSN 297-6240. FOR THE WASTE MODULE WORKSHOP, DESIGNATE YOUR REPRESENTATIVE BY 30 JUN 92 BY CONTACTING MR. JIM FRANSON AT SAME DSN. E-MAIL AND NEGATIVE REPLIES ARE APPRECIATED. MAJCOMS ARE ASKED TO SUPPORT TRAVEL FUNDING FOR THIS IMPORTANT EFFORT. ATTENDEES MAY CONTACT WPAFB AT DSN 787-3810 FOR BILLETING RESERVATIONS.

Appendix E: Glossary of Acronyms

ACC - Air Combat Command

AFB - Air Force Base

AFCEE - Air Force Center for Environmental Excellence

AFLC - Air Force Logistics Command

AFMC - Air Force Materiel Command

AIRS - Aerometric Information and Retrieval System

ALC - Air Logistics Center

AMC - Air Mobility Command

AMS - Area and Mobile Source Subsystem

AQCR - Air Quality Control Region

AQUIS - Air Quality Utility Information System

CAA - Clean Air Act

CAAA - Clean Air Act Amendments

CAS - Chemical Abstract Services

CEM - continuous emissions monitoring

CFCs - Chlorofluorocarbons

CHRIS - Chemical Hazard Risk Identification System

CO - Carbon Monoxide

COBOL - COmmon Business-Oriented Language

CONUS - Continental United States

CY - Calendar Year

DBMS - Data Base Management System

DDN - Defense Data Network

DEC - Digital Equipment Corporation

DEEV - Directorate, Environmental Management (Squadron level)

DERA - Defense Environmental Restoration Account

DEV - Directorate, Environmental Management (Wing level)

DFD - data flow diagram

DoD - United States Department of Defense

DSN - Defense Switching Network

DSS - decision support system

EM - Environmental Management

EPA - United States Environmental Protection Agency

EPD - Georgia Department of Natural Resources, Environmental Protection Division

ES - Environmental Subsystem

HAP - Hazardous Air Pollutant

HCFCs - Hydrochlorofluorocarbons

IBM - International Business Machines

IRS - information reporting system

MAJCOM - Major Command

MIS - management information system

MPS - Master Permit System

NAAQS - National Ambient Air Quality Standards

NAETS - Navy Air Emissions Tracking System

NAPSIS - Naval Air Pollution Source Information System

NEDS - National Emissions Data System

NOD - Notice of Discharge

NON - Notice of Noncompliance

NOV - Notice of Violation

NOX - Nitrous Oxide

NPDES - National Pollution Discharge Elimination System

PC - personal computer

PF - Primary Function

POC - Point of contact

PSD - Prevention of Significant Deterioration

POTW - Publicly Owned Treatment Works

RAM - random access memory

RCOs - Regional Compliance Offices

SARA - Superfund Amendments and Reauthorization Act

SDLC - systems development life cycle

SOX - Sulfur Oxides

TAC - Tactical Air Command

TPS - transaction processing system

UST - Underground Storage Tank

VOC - Volatile Organic Compound

VS - Virtual Storage

WIMS - Work Information Management System

WIMS-ES - Work Information Management System - Environmental Subsystem

XATEF - Crosswalk Air Toxic Emission Factor

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Vita

Captain Robert A. Cantwell was born on 5 March 1959 in Port Arthur, Texas. He graduated from Ross S. Sterling High School in Baytown, Texas in 1977. Upon graduation, he enlisted in the Air Force in the aircraft maintenance career field. His first assignment was with the 6594th Test Group at Hickam AFB, Hawaii where he served as a JC-130 flight instructor. His second assignment was with the 463rd Field Maintenance Squadron, Dyess AFB, Texas where he served as an aircraft maintenance technician. He was selected for the Airmans Education and Commissioning Program (AECP) in 1983. He then attended The University of Texas at Arlington on an AECP scholarship where he received the degree of Bachelor of Science in Industrial Engineering in December 1986. He attended Officer Training School at Lackland AFB, Texas. Upon graduation, he was commissioned a Second Lieutenant in the Air Force. His first assignment after commissioning was with the 67th Civil Engineering Squadron at Bergstrom AFB, Texas where he served as the Chief of the Industrial Engineer Branch and as the Squadron Section Commander until May of 1991. He entered the Graduate Engineering and Environmental Management (GEEM) Program at the School of Engineering, Air Force Institute of Technology (AFIT), in May 1991.

Permanent address: 1515 Connally Terrace
Arlington, TX 76010

Vita

Captain Jonathan S. Davis was born on 10 June 1963 in Valparaiso, Florida. He graduated from Sandpoint High School in Sandpoint, Idaho in 1981. He then attended the University of Idaho on an AFROTC scholarship where he received the degree of Bachelor of Science in Civil Engineering in May 1986. Upon graduation as a Distinguished Graduate, he was commissioned a Second Lieutenant in the Air Force. His first assignment was with the 23rd Civil Engineering Squadron at England AFB, Louisiana where he served as a Design Engineer in the Engineering Branch and then as the Chief of Requirements in the Operations Branch. In October, 1990, while still at England AFB, he was assigned as the Deputy Base Civil Engineer. He attended Squadron Officer School in residence in January, 1991. He entered the Graduate Engineering and Environmental Management (GEEM) Program at the School of Engineering, Air Force Institute of Technology (AFIT), in May 1991.

Permanent address: 11100 Hwy 95 North
Sandpoint, Idaho 83864

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Robert A. Cantwell, Captain, USAF
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The primary objective of this research was to develop the air module for the Work Information Management System - Environmental Subsystem (WIMS-ES). The air module will provide Air Force environmental managers with a management information system (MIS) to control the growing amount of air pollution data required to stay in compliance with the newly amended Clean Air Act. To develop the air module, the Air Force's air pollution management requirements were researched first. These requirements were then compared to the capabilities of existing air pollution MISs used in the Department of Defense, the Environmental Protection Agency, and in commercial industry. The research led to a draft air module that tracks a base's source inventory and associated permit, control equipment, and emission information. Each base's data will be fully accessible to headquarters personnel through the fully networked WIMS-ES. The draft air module was validated through an Air Staff review, an Air Force review, and finally, a workshop with Air Force air pollution experts. The finalized air module has been forwarded to the WIMS-ES programmers and will become the Air Force-wide air pollution MIS in early 1993.

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